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TRICSY: A SYSTEM FOR CODING PARENT-TWIN TRIADIC INTERACTIONS

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ABSTRACT

An important question is whether triadic interaction tasks provide additional information beyond dyadic tasks. We examined this issue in 103 triads of parents and twin pairs from the longitudinal Western Reserve Reading Project (WRRP). The triads analyzed were those who had participated in the Year 1 home visit assessment portion of WRRP. Aspects of triadic interaction were assessed from an 8-10 minute videotaped triadic domino task which was part of a larger 55 minute videotaped observation set. The dyadic interactions which preceded and followed the triadic task were coded using the Parent Child Interaction System (PARCHISY) and the triadic task was assessed using the proposed Triadic Interaction Coding System (TRICSY). The results showed that the proposed TRICSY coding scheme was a reliable assessment and coding instrument for the triadic domino task recorded in Year 1 of WRRP. There were no significant mean differences in the variables assessed in both the dyadic and triadic coded tasks. Additionally, there was no support for significant differential parental feelings, attitudes, or treatment as assessed in the study. Correlation analyses showed there were both similarities and differences in the relationships between the twelve measured variables shared by both the dyadic and triadic tasks. The results also indicated that the TRICSY triadic task coding scheme was not any more effective than the PARCHISY dyadic task coding scheme at predicting concurrent or future externalizing behavioral problems as indicated by HLM analyses. In conclusion, the TRICSY coding scheme was found to be a reliable instrument for coding the triadic interaction observed in the study but, the scheme did not provide any additional ability to describe or predict outcomes beyond that provided by the dyadic PARCHISY scheme.

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Chapter 1

INTRODUCTION

Parent-Child Dyadic Background

For several decades, dyadic research has focused on the relationship between parent-child interaction and cognitive and behavioral outcomes (see Maccoby & Martin, 1983 for a review). Among these studies is a number which examine specific aspects of the psychosocial development of children as a consequence of positive or negative relationship dynamics with their mothers. For example, Bryant & Crockenberg (1980) reported that differential treatment of siblings by their mother, particularly in controlling behaviors (r =.34, p < .01) and showing affection (r = .18, p < .05) was associated with more coercive peer relationships. Additionally, Stocker, Dunn, & Plomin (1989) found differential maternal treatment was related to more negative and increased competitive sibling interaction (r =.22, p < .05).

Furthermore, research in the area has also examined the impact of parenting style on the quality of the observed familial interpersonal interaction (Maccoby & Martin, 1983; Barton & Tomasello, 1991; Volling & Belsky, 1992; Kochanska, 1997). Specifically, some studies (Crowell et al., 1988; Maccoby, 1992) have focused on the relationship among positive and responsive maternal interaction in early childhood and its impact on later behavioral and social outcomes. Across the studies there has been a consensus on the defining aspects of positive and responsive maternal interaction. The

components of this type of interaction include, but are not limited to, sincere maternal sensitivity in response to their children's needs (Bryant & Crockenberg, 1980), a genuine encouragement of curiosity within their children (Brody, Stoneman, & MacKinnon, 1986), and the continued and consistent reinforcement of the importance of the feelings of others in their children's interactions (Dunn & Kendrick, 1982).

Parenting and Effects

Not all research has focused on the aspects of positive maternal parenting and associated outcomes. Other studies (Bryant & Crockenberg, 1980; Stocker, Dunn, & Plomin, 1989; Barton & Tomasello, 1991) have examined the effects of cold, inaffectual, or insensitive mothering during childhood. Studies such as these have indicated that this type of parenting has an influence on children's concurrent interactions with both parents. These studies have also consistently found that parenting with high levels of negative affect contributes to increased delinquent behavior, child externalizing ($r = .42$, $p < .001$), negative peer and sibling interaction($r = .40$, $p < .001$; Bryant & Crockenberg, 1980), and conflict.

As mentioned above, there is a wealth of published literature to examine the impact of maternal parenting style and affect on the psychosocial development of children. Much of this research has focused on familial, sibling, and peer interaction outcomes related to maternal influences. The research in this area provides a foundation from which research of other familial processes and interactions may be studied.

Not all studies of parent-child interaction are about or regarding mothers. Although considerably smaller, the literature on paternal influence and its impact on children's psychosocial development is just as important and meaningful. For example, MacDonald and Parke (1984) showed that fathers' socially engaging interaction with their sons was significantly correlated ($r = .50$, $p < .05$) with, and predictive of, later peer popularity levels. Patterson, Kupersmidt, and Geisler (1990) found that aggressive children perceived less affection from their fathers than did paternally neglected children F (2,374) = 4.52, $p < .01$). Results such as these help to demonstrate how paternal interaction provides a distinct and specific impact on child socialization, separate from that attributed to maternal interaction. Although the current study does not include a significant paternal involvement sample, it is nevertheless important to mention the impact of paternal interaction within the literature.

Mutuality and Synchrony

Two closely related and intertwined aspects of interest in the examination of parent-child dyads are mutuality and synchrony. Mutuality is defined as a type of reciprocity with shared mutual social contingency or responsiveness to a particular interaction-specific object or process (Belsky, Rovine, & Taylor, 1984; Dunham & Dunham, 1995). An example of parent-child mutuality would be a parent and child working on a puzzle together and taking turns, sharing emotional states, and both partners working together to complete the puzzle as a dyad. Synchrony, on the other hand, refers to the focused, mutual exchanges between partners in an interaction (Wahler, Williams,

& Cerezo, 1990; Isabella & Belsky, 1991). An example of parent-child synchrony would be shared emotional states or temperament. In simpler terms, mutuality can be defined as interactional synchrony (Deater-Deckard, Atzaba-Poria, & Pike, 2004).

Relationships high in mutuality are associated with optimal child socio-emotional outcomes such as externalizing problems (r =-.28, p < .01) (Deater-Deckard & Petrill, 2004; Deater-Deckard, Atzaba-Poria, & Pike, 2004). In contrast, relationships high in negative synchrony tend to promote and reinforce aggressive and aversive behavior. Harrist and Waugh (2002) found that in both parents and children the magnitude of the association was similar to those high in positive mutuality. Harrist's 2002 study also stated another important point that is central to the current study, "mutuality that is present and measured in individuals is distinct from that dyadic mutuality measured in a dyad" (Harrist & Waugh, 2002). The reason for the distinction lies in the fact that mutuality measured in an individual cannot properly take into account co-regulation of emotions and behavior the same way a dyadic measure of mutuality can. The influence of a second person on an individual is not always accounted for by an individually assessed mutuality measurement. Dyadic measures, in general, are able to include these additional external sources of influence and take them into account. Therefore, this methodological distinction would also theoretically be in place between a measurement of dyads and triads or larger interaction groups.

The use of synchrony or mutually focused, reciprocated exchanges between interactional partners (Harrist et al., 1994) is composed of three major components which seem to capture the essence of the important aspects of the concept. These three dyadic components are engagement, affective tone, and connectedness. The elements and their

respective balance seem to represent a meaningful and valuable way to describe variations in subsequent behavioral outcomes from a dyadic interaction. Within the construct of dyadic interactions, three discrete styles of interaction emerged; positive synchrony, negative synchrony, and nonsynchrony. As explained in the Harrist study, each style of interaction corresponded to a particular hypothesized subsequent outcome. Positive synchrony was associated with non-withdrawn behavior, prosocial and competent outcomes, whereas negative synchrony was associated with coercive and aggressive behavioral outcomes. Nonsynchrony was associated with higher rates of school aggression, increased social anxiety and greater withdrawn behavioral outcomes.

Psychosocial Development

Going further, several studies have examined the correlation between parent-child interactions and child developmental outcomes. With respect to psychosocial development of children, some studies (Dodge, 1983; Eron & Huseman, 1990) have found that childhood aggression, both within and outside of the family unit, appear to be associated with increased risk for future developmental difficulties such as peer rejection and delinquency. However, other studies (Coie & Kupersmidt, 1983) have shown an association between prosocial behaviors such as sharing and cooperating and downstream positive social outcomes such as peer acceptance. To supplement these findings Patterson and colleagues (1984), asserted from their observations that aggressive behavior and coercive exchanges among family members may serve as a “training ground for the development and maintenance of aggression” (Patterson, Dishion, & Bank, 1984).

Studies by both Dunn and Dale (1984) and Dunn and Munn (1986) have provided examples where positive, affectionate sibling and family interactions were often resultant in more cooperative and prosocial behaviors as time passed.

Deater-Deckard and Petrill stated in their 2004 article (Deater-Deckard & Petrill, 2004) that “the parent-child relationship is critical in the development of emotional and behavioral regulation processes.” This statement highlights the importance of the parent-child interaction in the overall development of the child as a social entity.

Sibling Interaction

Of particular interest are those studies which examine sibling interaction among children. The work of Patterson and Dunn (Patterson, Dishion, & Bank, 1984; Dunn, Stocker, & Plomin, 1990) in the area of sibling interaction provide a number of findings related to the development of aggression between siblings due to conflict and coercive exchanges. Dunn and Munn (1986) found that friendly and affectionate relationships in pre-school siblings fostered future pro-social outcomes. The current study looks to examine how the associations among these outcomes is impacted when another individual is incorporated into the interaction; thus, making the dyad a triad. Studies such as Lansford and Parker’s (1999) on friendship interaction provide vital stepping stones in the study of children’s interactions in triads beyond the dyadic context so familiar to many researchers. The study presented how analyzing peer interaction as a series of dyads isolated from the broader social context is inefficient. By merely focusing on dyads and not higher units of analysis the representation of experiences in the peer relationships

analyzed is incomplete. Hierarchies of dominance and influence are possible in triads as compared to dyadic interaction. The study further stated that simultaneous interaction in triads is more challenging and fragile than in dyadic interaction. Perhaps the strongest argument for moving toward a triadic and group interaction orientation is that dyadic relationships are somewhat limited in explanatory power in the ways described above. In many cases the relationship between interaction participants is tempered by some external relationship. There have been researchers such as Volling and Belsky (1992) who have attempted to analyze these relationships. The flaw in the method though was attempting to examine family dynamics as a set of dyadic relationships compared on outcomes.

Peer and Non-sibling Relationships

In addition to studies examining familial interactions, there have been studies which have investigated child-child relationships outside of the family unit. These studies have expressly focused on peer interactions (Hartup, 1993; Lansford & Parker, 1999; Hay, Payne, & Chadwick, 2004). Many studies of peer interaction tend to focus specifically on unique aspects of the interaction such as those related to gender and social behavioral differences among single sex groups of boys and girls (McLoyd, Thomas, & Warren, 1984; Benenson, 1990; Benenson, 1993; Ishikawa & Hay, 2006). Studies of this sort generally examine the hierarchies of dominance and influence within peer groups and how those hierarchies influence the overall behavioral and social dynamics of the group interactions (Corsaro, 1981). Analyses of peer interaction allow for the

investigation of social influence mechanisms not present in familial interactions. It is of note that studies of peer relationship dynamics are defined and evaluated by the same basic behavioral factors and social constructs as sibling and parent-child interactions. These types of analyses have the potential to assist in the study of how to account for social influence processes when tracing and interpreting dyadic, triadic, and higher order group interactions. The most common theoretical thread running through all of these studies is the impact of interpersonal relationships with other group members. These interpersonal relationships include both those within a familial context as well as those external and unique from familial interactions.

From a methodological standpoint, peer and group interaction studies have begun to investigate children at various stages of development by implementing longitudinal study designs and strategies. For example, researchers have investigated social interactions among infants as young as two years old (Benenson, Apostolaris, & Parnass, 1997; Lansford & Parker, 1999; Ishikawa & Hay, 2006). It has been proposed that older infants and toddlers are able to interact and actively participate in triadic social interactions. Though it is possible for these very young children to interact at a triadic level, the ability of the children to comprehend the complexity of the interactions is not explicitly demonstrated in a concrete behavioral and cognitive fashion until around five years of age (McLoyd, Thomas, & Warren, 1984).

Behavioral Genetics

In recent years an increasing number of studies have examined familial interaction relationships using genetically sensitive research designs. In particular, behavioral genetic methods decompose variance and covariance into genetic and environmental effects using specialized family designs. The relevance of these types of study designs to the current study is how they examine the variance accounted for due to specific genetic and environmental influences. For example, monozygotic (MZ) or identical twins share all of their genes in common, while dizygotic (DZ) or fraternal twins share on average only 50% of their segregating genes (similar to the percentage shared among non-twin siblings). Therefore, genetic influences are implied to the extent that identical twins are more highly correlated than fraternal twins.

Environmental effects are divided into two distinct types, shared environment (c^2) and nonshared environment (or e^2). Shared environmental influences are those attributed to the common environmental experiences among siblings. Some examples of shared environmental influences include common parental attention and books in the home. Nonshared or unique environmental influences are those influences that make family members different. Examples of non-shared environmental influences include differential parental treatment, different peers, and different classrooms within schools.

Using behavioral genetic methods, studies have focused on the etiology of dyadic mutuality utilizing both twin (Eley, Lichtenstein, & Stevenson, 1999; Deater-Deckard, Smith, Ivy, & Petrill, 2005) and adoption study designs (Eley, Deater-Deckard, Fombonne, Fulker, & Plomin, 1998; Deater-Deckard, Petrill, & Wilkerson, 2001; Deater-

Deckard & Petrill 2004). Within the adoption designs there is evidence to suggest a link among low levels of parent-child mutuality and elevated levels of child behavior problems. This link is consistent with other findings in the socialization literature which find a bi-directional relationship within parent and child interactions. Furthermore, within an adoption design these types of relationships do not support passive gene-environment correlations. A passive gene-environment correlation is when children passively receive family environments from their parents that are correlated with their genetic propensities. Instead, the stated adoption designs support individual genetically mediated aspects which may evoke a response from the interactional partner. Within the twin studies there is a consistent relationship between sibling similarity and levels of parent-child mutuality. The results of the studies seemingly point toward a combination of genetic and non-shared environmental overlap in the etiology and manifestation of parent-child dyadic mutuality. In two separate genetically sensitive designs these results point to a correlation between genetic and environmental variables, a gene-environment correlation.

Much of the more contemporary literature regarding the behavioral genetic aspects of parent-child mutuality (Rende, Slomkowski, Stocker, Fulker, & Plomin, 1992; Deater-Deckard & O'Connor, 2000; Spinath & O'Connor, 2003) examines the impact of genetic, environmental, and gene-environment processes. These influences are especially salient in the current study as all of the participating children are monozygotic (identical) twins. Differences in parent-child interactions may additionally be attributable to differences in the children's attitudes, temperament, or abilities (cognitive or social). A study by Pike et al. (1996) previously demonstrated that genetically variable attributes can elicit negative parenting outcomes via evocative gene-environment correlations.

Evocative gene-environment correlations are when individuals evoke particular reactions from others in their environment based upon their genetic propensities. The Pike et al. study specifically demonstrated how increased levels of child depressive behavior, a genetically variable attribute elicited increased maternal and paternal negative affect. Additionally the study also provided support for the links in non-shared environmental variables such as differential parental treatment of twins and future behavioral and social outcomes, such as antisocial behavior. Meanwhile, a study by Deater-Deckard (2000) illustrated how environmentally mediated variables and processes, such as control, affect, and discipline, impact both parent behavior and child-specific adjustment. However, each of the aforementioned studies only explored the attributes and outcomes of individual parents and children and did not investigate these processes at a dyadic or higher level of analysis. One of the goals of the current study is to evaluate if any differential parental or child-based factors have a measurable impact on the observed triadic interactions.

In order to establish a foundation from which to work, a sample of monozygotic (identical) twins was used in the analyses of the current study. By utilizing this type of sample, any differences found can theoretically only be attributable to differences in non-shared environment. The reason for this conclusion is that identical twins share all of their genetic and shared environmental influences, by definition, in common. For the preliminary establishment of differences detected by the proposed scheme, an identical twin sample is the most amenable type of sample. Potentially, if differences are found in the monozygotic (identical) twin sample, a dizygotic (fraternal) twin sample may be useful to analyze the potential influence of genetic differences in the individual differences.

Issues in Data Collection Methodology

Questionnaires

Using questionnaires to assess the dynamics of parent-child interactions has several advantages. These include low cost, ease of administration, and the ability to include visual aides such as diagrams or flow charts in the questionnaire for clarification (Salkind, 2006).

However, there are some disadvantages. Beyond issues related to literacy, questionnaires can potentially suffer from interpretational difficulties if the included items or responses are ambiguous (Trochim, 2001). One particular example that relates to ratings of parent feelings or behavior is how parent ratings of temperament in twins may often suffer from contrast effects (Saudino, 2003; Saudino, Wertz, Gagne, & Chawla, 2004). Contrast effects are when parents, in an attempt to differentiate the behavior of their twins, magnify their ratings beyond what actually exists. Contrast effects have been found in a number of both adoption and twin studies (Saudino, Cherny, & Plomin, 2000). These effects are often most evident in rating measures where parents are required to make global judgments of their children's behavior. However, when questionnaires are used in conjunction with behavioral observation or mechanical means, twin correlations are not adversely affected (Saudino, Wertz, Gagne, & Chawla, 2004).

Videotaped Observation

Another manner of data collection often used in observational studies is videotaping the interaction. As with the use of questionnaires or other methods, there are both advantages and disadvantages to the use of videotapes. In general, observational methods are less subject to the contrast effects present in other data collection methods. With videotaped observation there is a record of the interaction which can be subjectively viewed by an outside observer. Additionally, the use of videotaped observation allows an outside observer to deal with any potential bias parents or home investigators might have.

There are also disadvantages for the use of videotape data in analyses of parent-child interactions. These disadvantages often complicate both the use and analysis of gathered videotape data. For example, the use of videotapes may only provide a single "snapshot in time." Without other corroborating information, videotapes cannot provide a full and meaningful representation of the true dynamics of the observed interaction. Another potential threat to the validity and reliability of videotape data is social desirability. These previously mentioned issues have the potential to add bias to the coding of videotape data or may alter the actions of participants during the videotaped interactions. Specifically, social desirability can lead participants to act in a manner which they believe the observers would wish them to act, even though those actions are not truly representative of their own actions or feelings.

Triadic Interaction

Compared to the more established and voluminous research and publication tradition of dyadic interactions, research in the area of triadic and group interaction is much less robust. Many early studies of triadic interaction (Parke, Power, Gottman, 1979; McHale & Fivaz-Depeursinge, 1999) focused on a specific model; two parents and one child. Examples of studies using this model are the prenatal Lausanne Trilogue Play situation (pLTP), (Carneiro et al., 2006) in which expectant parents were asked to role play their first interaction with their baby using a doll, and the postnatal Lausanne Trilogue Play situation (Fivaz-Depeursinge, & Corboz-Warnery, 1999) in which parents interacted with their actual infant.

Studies of early (infant and toddler) interaction, such as the postnatal Lausanne Trilogue Play, have found that gaze is an important factor in triadic interactional dynamics. However, in later developmental periods, the ability of the caregiver to gain and maintain the attention of the child as well as communicate directions and suggestions to the child at an appropriate level become more important. Other early studies focused on a clinical outcome or problem such as how the family deals with a child who is suffering from a conduct or attention disorder. These examinations of family processes with a child who has clinical and/or psychological problems served as the gateway to the exploration of triadic interactions within families. Over time the general focus of the triadic interaction has shifted from a clinical focus to a more non-clinical family-based focus. Early family studies investigated the processes of familial interaction and the development of family communication within the context of various dyadic relationships.

For example, it has been postulated that families with two parents and a child have three subsystems working within them; the mother-child interaction, the father-child interaction, and the marriage interaction (Margolin, Gordis, & John, 2001; Frascarolo et al., 2004; Carneiro et al., 2006). Further, it has been stated that these three interacting groups all have a particular impact on one another and that the marriage interaction and satisfaction within it may be the most efficient predictor of the true familial triadic interaction.

There is a strong inclination to link directly the quality of parental familial interaction to linguistic ability and development of the children within the family (Tomasello, Mannle, & Kruger, 1986). This approach has gained favor in the triadic and group interaction literature as compared to the dyadic literature. This is due to the fact there is more opportunity for communication and interaction in a group than there is within a dyad. Particularly, the study of linguistic development has taken root in triadic interaction research due to an assumption by early researchers that improved linguistic communication was essential and central to effective triadic processes.

Furthermore, in familial studies involving both parents, each individual child's interaction and relationship with each of their individual parents has an impact on the quality of the interactions involving the other parent as well as their relationship with their co-sibling (Patterson et al., 1990).

Studying triadic systems and their underlying processes compared to lesser order systems such as dyadic or individual models is essential to understanding the components common to both triadic and lesser order systems, and can be examined through the application of general systems theory principles. The complexity of triadic interactions

above and beyond that of the more studied dyadic interactions is one of the major factors contributing to the relatively small number of studies exploring, applying, and interpreting triadic interactions. The analysis of triadic interactions enrich the understanding of the common and unique processes intrinsic to both dyadic and triadic interactions.

All of the previously noted studies as well as others have brought to the forefront some of the most difficult aspects to overcome when studying complex processes such as interpersonal interactions; the struggle to assess direction of causality and the impact of that assignment of causality on both behavioral and social outcomes. While examining the overall quality of interactions that underlie the processes explored by these and other researchers, it is important to recognize as explained by Parke (1988) that individuals, dyads, triads and families each constitute unique units of analysis.

Though the goal of the present study is to look beyond the comparatively simpler dyadic interaction situation and explore some of the processes that underlie the more complex triadic interactions observed, it is important to remember how differing levels of interaction complexity may impact the behavioral and social outcomes measured and observed. Though the measures used to assess some observed variables such as positive affect, cooperation, and conflict may be similar to those used in less complex interactions, the added level of intricacy in triadic interaction can potentially provide a more robust opportunity to reveal more complicated processes and explanations of outcomes. It is the ability of the triadic analysis methodology to explain variance beyond that of the dyadic method that is at the center of the current study. By observing and coding the interactions among different family members in the same family, it is hoped

that some of the underlying processes within the family that were not able to be uncovered through dyadic coding may be revealed and used to predict future behavioral outcomes. Through the analysis and explanation of these various processes it is plausible to believe that further understanding of familial and group interactional processes may be gained.

The aspects of studies such as Harrist et al. (1994) in which dyadic mother-child synchrony was expressed and used as a metric to attempt to predict future child-based school behavioral outcomes appears to warrant merit in the evaluation of both dyadic and triadic coding systems and their respective predictive capabilities. The focus on parent-child interaction as a fundamental example and influence on future behavioral and social outcomes should not be underestimated. As research has used the family as a basic unit of analysis and influence for dyadic interactions for decades, it is fitting that it should be the focus of a study of higher order interactions as well.

To summarize, the literature on aspects of influence on and within familial dyadic interaction is vast and the literature related to triadic or higher order familial interaction is less developed. There is a need to cultivate means of analyzing these higher order interactions and their links to behavioral and psychosocial correlates which have been explored in dyadic interactions. The need arises from a desire to understand the increasingly complex social environment in which the dyadic interactions are embedded and how the larger environment influences these interactions. In this vein, exploration of the aspects of both higher and lower order interactions may be able to elucidate any number of processes present in or unique to those interactions and their contribution to any number of outcome measures. Studies of dyadic mutuality such as those conducted

by Harrist and Waugh (2002), focus primarily on positive relationship and interaction aspects of emotional warmth and reciprocity. Though emotional warmth and reciprocity are strong and reliable variables that are more easily measured in dyadic relationships, in more complex interactions it may be possible that measuring and accurately differentiating levels of these variables is important to the overall dynamic of the core interaction.

Study Goals and Hypotheses

The purpose of the current study is to address four goals and four specific research hypotheses. These goals and hypotheses will primarily examine data collected and coded using the Parent Child Interaction Coding System (PARCHISY; Deater-Deckard, Pylas, & Petrill, 1997), a coding system for dyadic videotaped interactions, and the Triadic Interaction Coding System (TRICSY), a coding system specifically developed for triadic interactions. The first goal is to develop and test an observational triadic coding system based upon videotaped observations of parents and identical (monozygotic) twins. The second goal is to examine the correlation of the twelve shared measured variables common to both the PARCHISY and TRICSY coding schemes. This goal will examine specific aspects of the schemes such as the relationship processes of cooperation, conflict, and reciprocity. In particular, we hypothesize that the measured triadic task and relationship processes will be moderately correlated with those same relationship variables measured in the dyadic observations. We additionally hypothesize that the triadic observational variables will provide descriptive power as assessed by

correlation and mean difference analyses beyond that of the dyadic scheme in those variables shared among both systems. The third goal is to investigate the relationship between concurrent (Year 1 assessment) parent feelings/attitudes and child behavior problems and the dyadic and triadic scheme observational measures. In particular, the goal is to determine whether the measured triadic constructs predict variability in these socio-emotional and behavioral outcomes beyond the dyadic measures. It is hypothesized that the triadic task will predict additional independent variance in concurrent measures of parent and child behavior beyond that accounted for by the dyadic tasks. The fourth goal is to test the predictive ability of triadic task observations with later (Year 2 assessment) parent and child measured outcomes and variables from the PARCHISY and TRICSY schemes. It is also hypothesized that the triadic task will predict additional independent variance in the prediction of future behavioral outcomes beyond that predicted by the dyadic tasks. In summary, the general goal of this study is to determine whether the triadic observations can be reliably coded, and whether they account for variance in concurrent and longitudinal parent and child outcomes beyond what can be explained by the dyadic scheme observations.

Chapter 2

METHODS

Participants

Study participants were drawn from the larger Western Reserve Reading Project (WRRP), a longitudinal twin study involving 352 pairs of same sex fraternal (n = 170) and identical (n = 126) twins from Ohio. The remaining pairs of twins (n = 56) had not, at the time of this study, been genotyped for categorization. The major aims of WRRP are to examine genetic and environmental influences on early reading and literacy development. Study data were collected by means of mailed questionnaires and in-home observation conducted annually for three years. Figure **1** displays a general schematic representation of the study design with the three currently collected assessment and home visit time points represented.

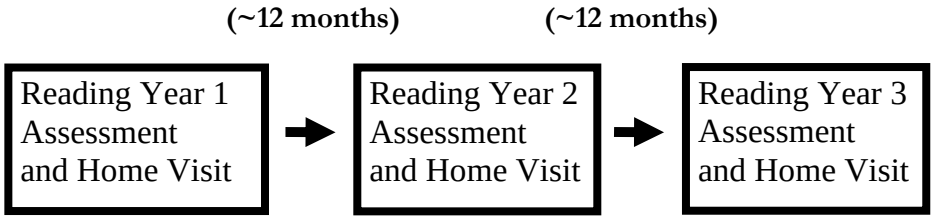

Figure **1**: **Organizational structure of WRRP assessment occasions.** Each box represents one set of questionnaire assessments and the home visit for each WRRP family. As indicated, there are approximately twelve (12) months between each questionnaire assessment and home visit set.

Participating twin pairs and families were specifically recruited when the twins were in kindergarten or first grade (Year 1 assessment).

From the larger WRRP sample we studied 107 monozygotic (MZ) twin pairs and their families who had participated in the Year 1 home visit and the Year 2 questionnaire assessment portion of the larger Western Reserve Reading Project. These twin pairs were between the ages of 5 and 8 years old (65% female, mean age = 6.09 years, SD = .73, mean Stanford-Binet 101.1, SD = 14.3) at Year 1 assessment. Of the 107 families visited, 103 families had usable videotaped observational data. Four families did not have usable videotape data because of; 1) poor lighting, 2) improper camera placement, 3) excessive light exposure, or 4) a parent-child configuration in which both children had their backs to the camera.

The overwhelming majority of the current study sample (93%) was self-identified as White. Parental educational attainment was skewed with 87% of parents reporting having completed at least some college, 30% having received a Bachelor's degree, 20% having obtained a graduate or professional degree, and only 2% of participating parents reporting not having completed high school. Mothers comprised a significant portion (87%) of the participating parent sample. The average age of participating parents was 39.0 years old (SD = 5.6). These demographic characteristics are almost identical to those of the 142 dizygotic (DZ) twin families.

Design and Procedure

General Home Visit and Videotaped Interaction Procedures

The home visits were designed to measure parental and child growth on reading and behavioral outcomes, such as internalizing and externalizing. Figure **2** shows the general format of a home visit with the average estimated time of each set of assessment tasks in parentheses. The measured outcomes collected during the visit included psychometric assessments and videotaped interaction data. A battery of tests assessing reading skills and general cognitive ability was administered to each twin during each two and a half (2.5) hour home visit. As seen in Figure **2**, at the beginning of each home visit each twin pair was tested in separate adjoining rooms, where possible. The first twin began the home visit with the participating parent and engaged in three dyadic observational interaction tasks. Tasks included in the dyadic (parent and each twin individually) videotaped interaction were an etch-a-sketch task, a puzzle or labyrinth task, and a shared reading experience. Each of the dyadic videotaped tasks lasted approximately eight minutes and in total twenty-four minutes.

At the same time the videotaped interaction was taking place with one twin, the second twin worked with a home tester, usually in an adjacent room, to begin the psychometric assessments, including a short form of the Stanford-Binet Intelligence Scale (Thorndike, Hagan, & Sattler, 1986), the Woodcock-Johnson Reading Mastery Test-Revised (Woodcock, 1987), the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999), and the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002). After the videotaped dyadic

interaction tasks were completed by the parent-first twin dyad, the second twin's testing was suspended to allow for that twin to participate in the videotaped interaction tasks. In the first year of the larger WRRP study, an additional eight minute task was included, a triadic domino task, as shown in Figure **2** . This task was conducted after the first twin completed the etch-a-sketch, labyrinth, and shared reading dyadic tasks After the triadic domino task, the second twin then participated in the dyadic videotaped interaction tasks with his or her parent for twenty-four minutes. Once the second videotaped interaction was completed the second twin completed his or her psychometric testing, if necessary.

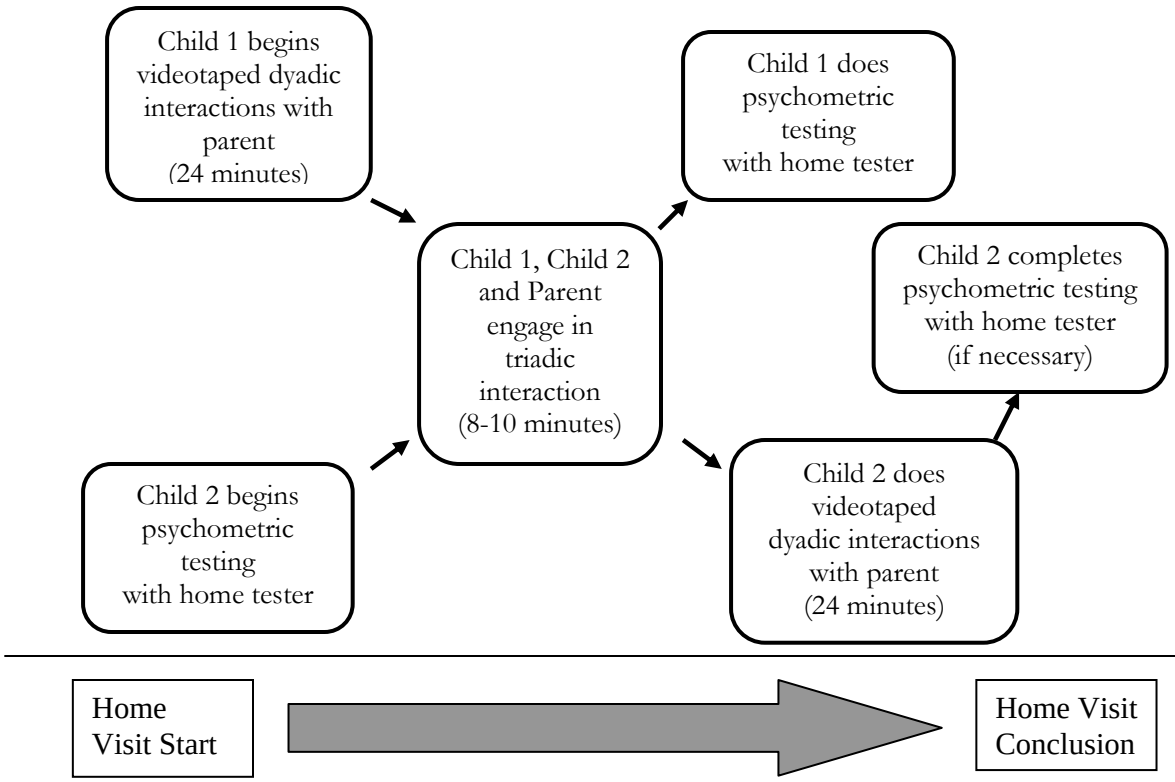

Figure **2**: **Order and organization of assessment elements during the WRRP Observational Home Visit.** As the home visit progresses from left to right, one child participates in dyadic videotaped interaction while the other begins psychometric assessment with a home tester. After 24 minutes, both children engage in a triadic task. After the triadic task, the first child does his or her psychometric testing and the second child engages in dyadic interaction with his or her parent. If the second child needs to complete his or her psychometric testing, the child does so after completion of the dyadic tasks.

Dyadic and Triadic Videotaped Interaction and Coding

The videotaped triadic domino task encompassed an 8-10 minute portion of the longer 55-minute videotaped dyadic and triadic interaction set. Figure **3** shows the structure and order of the videotaped interactions included in Year 1 of the WRRP study.

As previously noted and seen in Figure **3**, each child participated in all three of the eight minute dyadic tasks in turn with the participating parent. The triadic interaction is at the midpoint between the dyadic task sets for each parent-twin dyad. Additionally, as seen in Figure **2**, the videotaped triadic domino task was the midpoint of both the home visit and psychometric assessment as a whole.

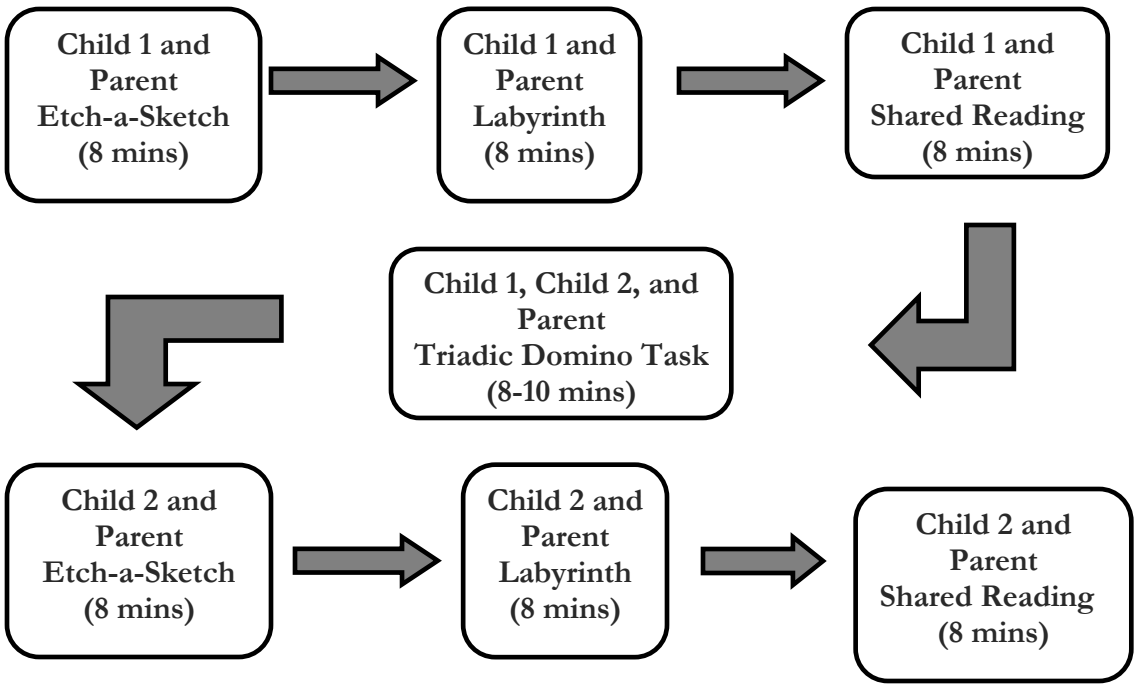

Figure **3**: **Order and organization of assessment activities during the videotaped interaction of the WRRP Observational Home Visit.** The order of the videotaped dyadic and triadic portions of the home visit follow a specific order. The dyadic interactions involving the first child and parent are first. The triadic domino task with both children and the parent is next. The final section of the videotaped interaction is the dyadic tasks with the parent and second child.

Measures

The assessments and observations coded from the dyadic interaction tasks as well as the measures used in the triadic interactions tapped into various social constructs present within the interactions. In order to validly and reliably assess these social and interaction based dynamics, a specific and unique triadic coding scheme was designed and implemented for use with the data. The dyadic and triadic coding schemes employed in the current study and the processes of evaluation are described in the following sections.

Parent-Child Interaction System (PARCHISY)

Previously, two of the three dyadic tasks, the Etch-a-sketch drawing task and the labyrinth puzzle task were coded using the Parent-Child Interaction System (PARCHISY: Deater-Deckard, Pylas, & Petrill 1997). A list of all of the variables used and coded in the PARCHISY scheme can be seen in Appendix A. What follows is a description and explanation of the procedure of the dyadic etch-a-sketch and labyrinth tasks.

The dyadic etch-a-sketch task used in the home visit involved a twin and the parent working in tandem to recreate a computer drawn house pattern. The participating pair was informed they had eight minutes to complete the task. Each individual was assigned one of the two control knobs of the toy. In the interaction instructions it was stated that each individual would only be allowed to operate and touch his or her own control knob on the etch-a-sketch. The parent was restricted to only using the left-right (horizontal) knob and the child was, in turn, restricted to only use and touch the up-down

(vertical) knob (Deater-Deckard & O'Connor, 2000). Other than these instructions and restrictions, the pair was allowed to communicate freely to complete the task working cooperatively in the eight minutes given. Once the allotted eight minutes ended, the home tester removed the etch-a-sketch and began to give instructions pertaining to the next task, the dyadic labyrinth task.

The dyadic labyrinth task is similar to the etch-a-sketch task in format and design. Each parent-child dyad was instructed to work cooperatively to complete the task with specific instructions. The labyrinth task involves the use of a wooden labyrinth puzzle game with two control knobs which controls the tilt of the puzzle board vertically and horizontally. As for the etch-a-sketch task, the child is told he/she controls the up-down (vertical) knob and the parent controls the right-left (horizontal) knob. The goal of the task was to progress a small metallic ball through the maze, while avoiding the holes in the puzzle board. If the ball fell through a hole, it could be collected and the task would resume from the point at which the ball fell through. If the dyad was able to complete the maze forward before the eight minute time limit was reached, they were instructed to attempt to go backward through the maze following the same set of guidelines as previously given. To facilitate the task, some of the holes in the puzzle board were covered. This facilitation helped reduce frustration and increase the ability of the task to be completed within the eight minute time limit, while still maintaining some challenge. Following completion of the dyadic tasks, the twin who had not been a part of the dyadic interaction was brought in to join in the next task, the triadic domino task.

Triadic Interaction Coding Scheme (TRICSY)

The triadic task, which involved both of the twins and the participating parent, was set around an 8-10 minute domino task. During the task each member of the triad was given approximately ten dominos and instructed to work cooperatively with the other members of the triad to recreate four patterns (two parallel straight lines, two wavy lines, a branching tree diagram, and a spiral design). Each design was provided on separate 8.5”x 11” laminated sheets of paper with black ink printed large enough to be seen easily by all individuals. Further, the children and parent were instructed by the home visitor to use only his or her own dominos to create each pattern. Each individual was also told not to touch or adjust another member’s dominos. In addition, participants were instructed to finish each design fully, to then redistribute the dominos equally, and proceed on to the next design. Finally, the triad was informed that if they completed all of the designs before the home observer returned in 8-10 minutes, they could create any designs they wished with the remaining time. It is worth noting that at no time was a preferred orientation of the dominos (standing up or laid flat) or prescribed order of completion for the designs provided; instead, these decisions were left to the participants.

The proposed Triadic Interaction Coding System (TRICSY) was designed as a modification of two previously compiled observational coding systems. First we used the Parent–Child Interaction System (PARCHISY: Deater-Deckard, Pylas, & Petrill 1997) to assess dyadic parent-child interactions along the following domains: parental warmth and control, parental negative affect and negative control, parental responsiveness to children’s questions and behaviors, parental verbalizations, child positive and negative

affect, child responsiveness to parental stimuli, child on-task behavior, child non-compliance, child leading of tasks, child energy, child verbalizations, as well as parent-child reciprocity, conflict and cooperation.

Second, TRICSY was drawn from unpublished dissertation project work compiled by Dr. Jessica Smith at the University of Oregon, who was supervised by Dr. Deater-Deckard. Her system, the observed sibling interaction rating system, was developed for use in her research of sibling relationship quality with the Texas Multiethnic Sibling Study (unpublished, 2005). Dr. Smith's system was a slight modification of the PARCHISY. Her system was created "for use with the more egalitarian relationship characteristic of siblings compared to parent-child pairs" (Smith, 2005).

Both the PARCHISY and the observed sibling interaction rating systems were designed to allow for observers to effectively code his or her global interpretations and impressions of the various behavioral constructs that were assessed within each particular scheme as observed in the 8-10 minute videotaped interaction. It is for these reasons that many of the same measures were used in the creation of the current coding scheme. The measures used and drawn from the previously mentioned coding schemes will be discussed in detail below. Additionally, procedural and definitional modifications for use of the system with triadic interactions were made. One specific example of these modifications is that the triadic task coding was conducted in three viewings to allow for more thorough and consistent coding. For a complete breakdown of the coding schemes and their constructs, see Appendix A (PARCHISY), Appendix B (observed sibling interaction global rating system), and Appendix C (TRICSY).

There was a number of specific constructs which were modified for use with the current system. Specifically, the dyadic measure of cooperation was adapted from the PARCHISY and modified to be measured for all of the dyadic combinations present in the current study (Child 1-Child 2, Parent-Child 1, and Parent-Child 2). In the same way the dyadic constructs of conflict and reciprocity were taken from Dr. Smith's system (Smith, 2005) and fitted into the current scheme. Dr. Smith's terminology, wording, and usage of the individual level global ratings of positive affect, negative affect, and verbalization were also carried over to the current scheme. The shared individual (Child 1, Child 2) sibling ratings of responsiveness to parental cues and non-compliance with parental requests and suggestions, seen in both systems was also deemed to be valuable in the assessment and evaluation of the triadic interactions and were retained. Specifically for the triadic interaction scheme, three new measures were added to the system: a general sibling-parent dominance, a comparative sibling-parent dominance, and an overall coder rating of level of cooperation versus conflict among the parent and children within the context of the triadic interaction. Appendix D shows a breakdown of all of the measures used and coded in the TRICSY scheme and in which scheme(s) the variables appear.

For the current coding scheme (TRICSY), all of the individual and dyadic level constructs (with the exception of the comparison measures) were assessed and coded using a 7-point Likert-type scale. These items were coded with a value of 1 representing absence of the particular behavior and a value of 7 representing consistent, continual presence of the particular behavior within the triadic interaction episode. There were certain behaviors which had to be reverse-coded so as to make logical sense when

analyzed with the other variables. Specifically, the three measures reverse-coded were negative affect, non-compliance, and dyadic conflict. The complete TRICSY coding rubric can be seen in Appendix E.

Training and Reliability

Coding was completed by four coders. Training and coding were conducted in a similar fashion as previously discussed in Deater-Deckard, Atzaba-Poria, & Pike (2004) and as detailed as follows. First, a general training session was held to familiarize each coder with the coding system and to establish how reliability would be calculated and measured. The procedure and specific items coded, which are explained in detail below, called for each assigned coder to observe and rate a particular sibling (Either "Child_1" or "Child_2") and the parent during the various phases of the coding procedure. Each coder was assigned to 26 videotapes as primary coder. Additionally, as was standard operating procedure for the project, 19 videotapes (approximately 20%) of the 107 videotapes were viewed and coded by all four coders on all aspects of the coding scheme for use in reliability analyses with Cronbach's alpha (Bakeman & Gottman, 1986). These 19 videotapes were chosen randomly from the pool of videotapes each coder was responsible for completing.

Coding Procedure

Each of the four coders was assigned to watch and code approximately 26 videotapes. Each coder was responsible for watching his or her assigned videotapes with one other member of the coding team for consensus coding, with the exception of the videotapes marked for reliability analyses which all four coders watched (as discussed herein). The criterion for visually differentiating the twins, when necessary, was directed by a predetermined hierarchy. The order of the identification criterion for twin differentiation was as follows: differences in color of the children's shirts (twins were told to wear different clothes prior to the home visit), differences in the color of the children's pants, presence or absence of glasses, major color differences in hair color or hair accessories, differences in presence or absence of other miscellaneous accessories such as socks, bracelets or rings, and, if all other options were exhausted, position on screen.

After identifying the children, each coder then indicated on his or her coding sheet that they were coding for the monozygotic twin triadic interaction project. The coders then selected the appropriate parent-child sex combination (e.g., mother and 2 sons, father and 2 daughters). After recording these two pieces of information, the coder then forwarded to the section of the videotaped interaction which contained the 8-10 minute triadic interaction sequence mentioned previously and as seen in Figure **3**.

All videotaped interactions were watched at least twice during the course of normal coding. The first viewing was strictly for the purposes of observing and coding the individual specific coding items seen in Appendix C and described below. The second

viewing of the interaction by the coders was for coding and scoring of the dyad-specific coding items as well as the triad-specific coding section seen in Appendix C. In addition, if a videotape included “Free Play,” a third viewing became necessary and required by the stated project coding protocol for requisite and proper coding. This viewing was necessary as not to confuse interactions present in the structured triadic interaction with those in the “Free Play” segment.

The viewing guidelines described above constituted a minimum number of times a videotape was required to be watched. However, sometimes coders were unable to satisfactorily code and assess the interaction merely based upon the minimum number of viewings and their discussions. In those instances, additional viewings were necessary and performed at the discretion of the coding team.

Provided below are the specific areas and variables for which each coder was responsible for coding while viewing the videotapes. During the course of normal coding (non-reliability coding) each coder was responsible for observing and scoring his or her assigned child and the parent in the individual general coding section, the dyadic interactions involving his or her assigned child in the dyad specific coding section, and all three of the variables within the triad specific coding section. Also, if applicable, each coder was responsible for coding all of the variables in the “Free Play” section.

With respect to coding the videotapes through multiple viewings, it was deemed appropriate that at the conclusion of each coding occasion the coding team would discuss those variables in each section for which they were both responsible for coding and resolve any discrepancies which occurred in those variables (Deater-Deckard, personal communication, July 9, 2006). This conversational exchange between coders helped to

ensure that both coders were in agreement about what they had both observed and that if there were any major disagreements in coding, that they could be resolved with another viewing and re-evaluation of the coding, if necessary. The consensus coding employed in this particular study was meant to examine to what degree the coders were observing the same phenomenon within the interaction. Each coder arrived at an individual item rating and then, after viewing the videotape, shared their value with their coding partner. If the coders agreed, there was no further discussion. If a disagreement in values occurred, the coders decided what the grounds of the disagreement were and whether an additional viewing was necessary and moved on from that point. After all of the necessary sections of the coding sheet had been filled in and any consensus coding discrepancies had been discussed, the data were then entered into an SPSS 12.0 (2003) database for storage and later analysis.

Coding Items

Twin/Parent-specific Coded Items

During the first viewing of the videotaped triadic domino task interaction, each coder was asked to rate an individual twin on six individual items and the participating parent on three individual items. The six items each coder was assigned to code for his or her particular twin within the twin specific coding section were: positive affect, negative affect, responsiveness, non-compliance, autonomy/independence, and verbalizations. In addition, the participating parent was also rated on positive affect, negative affect, and

verbalizations by the coder. Each of the twin/parent specific coding items and their coding criteria are explained in detail.

Positive affect was coded on the basis of the warmth that was expressed by the target individual in the form of explicit observed smiling, laughing, and other positive gestures (behaviorally and verbally) during the course of the triadic interaction task. In contrast, negative affect was coded on the basis of the explicit observed negativity in the form of anger, sadness, verbal rejection, frowning, and/or the use of cold and harsh voice tones by the target individual toward another member of the triad during the domino task.

Responsiveness of the target twin to the participating parent's questions, comments, and behaviors was also assessed. The responsiveness item included all behavioral and verbal responses by the twin to any verbal or behavioral action or gesture forwarded by the parent during the course of the triadic domino task. The item merely assessed whether there was a response to a parent's attempt at interaction. No judgment of the positivity or negativity of the interaction was assigned or given.

The non-compliance item was a measure of the degree to which the child willfully and purposefully ignored, refused, or acted directly in opposition to the wishes, demands, or requests of the parent.

The item for level of autonomy or independence displayed by the twin was assessed by observing and reporting the degree to which the target twin took a direct teaching or directing role in the task. The leading or directing role of the child had to be undertaken without any parental prodding or explicit direction of any kind. This was meant to be a measure of the amount the twin made an active attempt to lead or control the task. Finally, the amount of verbalization (talking, singing, or verbal sounds) uttered

during the course of the task was coded for each target twin as well as for the participating parent.

After all of the individual specific items were coded by the corresponding coders and discrepancies in the parental coded items were resolved through discussion, the coders were then able to fill in the child-focused comparison measures of the individual items of positive affect, negative affect, responsiveness, non-compliance, autonomy, and verbalizations. These measures and the significance of the differences were calculated by subtracting child 1's value from that coded for child 2. A difference of one category or no difference in categorical classification between the twins was deemed to be no difference between the siblings. If the difference between the siblings was equal to two categories, then the difference was deemed to be slight. If the difference between the twins was greater than two categories, then the differences were deemed to be significant. The direction of the significance was attributed to the child with the higher categorical rating.

In addition, the coders also filled out a section of parent-focused comparisons with respect to the participating parent's autonomy in comparison to the twins and whether the parent verbalized more with one twin than the other. The parent-focused autonomy comparison item was meant to assess whether the parent led the task completely or whether one or both twins led the task to a greater degree than did the parent.

During the course of the first viewing the coders also noted the predominant orientation of the parents and children. These orientations represent gross positioning relative to one another and have no direct measurement of posture, body angle, or mean distance from one another. If the general orientation of the triad was not provided in the

examples provided, the coders were instructed and given space to draw and explain the orientation seen on the screen on their coding sheets.

Dyad-specific Items Within the Triadic Interaction

During the second viewing of the triadic interaction videotape, each coder was asked to observe and rate the dyadic interactions in which his or her assigned twin was involved. For example, if coder 1 was responsible for "child 1," then coder 1 would be responsible for coding the child 1-child 2 dyad as well as the child 1-parent dyad for the three items which comprised the dyadic coding section. In the previous example coder 2 would also be responsible for the child 1-child 2 dyad as well as the child 2-parent dyad. The three items the coders were responsible to code within the dyad specific coding section were dyadic reciprocity, dyadic conflict, and dyadic cooperation.

The first dyad-specific item coded by the raters was a measure of dyad-specific reciprocity. The reciprocity item was meant to tap into the amount of shared positive affect (e.g., joking and shared positive conversation) in the dyad. In addition, reciprocity was also evident and described by explicit positive eye contact and a conversation-like style and quality to the dyadic interaction.

The second item coded was an item assessing the amount of conflict shown in each of the target dyads. Conflict in this context was defined as any minor or major disagreement that involved mutual and shared negative affect. Behaviors included in this description were arguing, fighting over test materials, and general aggression toward the other member of the dyad, either behaviorally or verbally.

The final dyad specific item assessed by the raters was a measure of dyadic cooperation. This item specifically examined the amount of explicit agreement and discussion within the dyad on how to proceed and best complete the domino task. This item examined the presence of a teamwork ethic in contrast to an "everyone for themselves" mentality.

Triad-specific Coded Items

In addition to filling out the dyadic coding section following the second videotape viewing, the coders were asked to code three items in the triad specific coding section.

The first was an item rating the twin-parent triad on a general assessment of the level of sibling specific dominance within the triadic interaction. Specifically, this item defined dominance as the unequivocal denial of resources or opportunity (e.g., parental attention or task materials) from the other twin. A twin was said to have dominated the task if they were the main attention focus of the interaction and that focus contributed detrimentally to the quality of the triadic interaction as a whole.

The second item was the sibling-parent triadic interaction dominance comparison item. This item, in contrast to the previous item, was focused on assessing whether the participating parent or the twins were more in control of the triadic interaction overall. More directly, this item assessed whether there was more dominance throughout the task by the twins over the parent, more dominance by the parent over the twins, or whether both the parent and the twins shared equal control and dominated the interaction equally.

Finally, the third item was a rating of the balance or inequity of overall conflict and cooperation within the triad throughout the task. The three response options allowed for more conflict, more cooperation, or equal parts conflict and cooperation in the interaction.

"Free Play" Coding

As it was noticed during the initial training phases that some families engaged in triadic interactions after the domino task had concluded but before time had expired, there was an additional section added to the coding protocol. This additional section was dedicated to interactions within the triad with specific focus on potential differences in twin behavior outside of the "structured" domino task. This particular unstructured activity coding section was called "Free Play." Coders were instructed to view and code this "Free Play" if it lasted for a period of at least one minute. Coders were responsible for recording the start and stop times of the "Free Play" session. Not all families engaged in this particular aspect of the coded interaction. Only those families who had completed all of the assigned domino patterns in less than the 8-10 minute time limit had the opportunity to engage in "Free Play." Approximately 20% of the observed families (20 total families) engaged in and were coded for "Free Play" in the current study.

The five items the coding team was responsible for assessing in "Free Play," if it occurred, were comparison level assessments examining potential observed differences in "Free Play" and domino task levels of positive affect, negative affect, conflict, and cooperation among the siblings. In addition, there was also an item examining the level of

dominance by the siblings during “Free Play” as compared to observed levels during the domino task. Each item had three potential response options encompassing either greater levels of the behavior, lesser levels of the behavior, or no change in the level of the behavior in the domino and “Free Play” interactions.

Reliability Coding

For the purposes of measuring and analyzing inter-coder reliability, a subset of 19 randomly selected videotapes was selected to be viewed and scored by all of the coders. The only criteria for selecting these videotapes was that there was an equal number selected from the pool of videotapes which each coder was responsible for viewing and coding. All reliability videotapes were used for full data analysis in the final analyses with the coder who was primarily responsible being entered as the coder for child 1 and a randomly selected partner as the second child coder. These videotapes were scored and viewed in a manner similar to those for “normal” coding. The only exceptions were that the reliability videotapes had to be watched a minimum of four times for proper requisite coding and there was no discussion of discrepancies in the coding at the time of viewing. The reason for the change in the minimum number of viewings for the reliability videotapes stemmed from the need to view both children in the twin specific and dyad specific coding sections. The procedure of watching each reliability videotape separately for each child helped to reduce the potential of contrast effects that could bias the data if all of the child specific coding was done during a single viewing with the coder having to split attention unduly between both children at the same time. All

reliability videotapes were entered into an SPSS 12.0 (2003) database, which was separate and configured differently from the main database. The reliability database was constructed in such a way that each coder had his or her own variable columns and each line represented a family. After the viewing, coding, and entry of 6, 12, and 19 reliability videotapes into the reliability database, inter-rater reliability analyses were conducted (Bakeman & Gottman, 1986). These analyses were done using SPSS 12.0's reliability function with each of the four coders representing separate "items" on the overall "scale" of the rated variable. The specific measures of interest in the output for each coded variable included scale alpha, item range, item variance, and scale alpha if the item was deleted. These analyses were run on all of the variables in the child specific, parent specific, and dyadic coding sections, as was appropriate by scale.

Outcome Measures

The psychosocial outcome variables of interest in the current study consist of questionnaire measures collected from teachers and parents rating children's externalizing behavior and parent feelings and attitudes toward their twins. Both concurrent (Year 1 assessment) and later (Year 2 assessment) child externalizing behavioral data are used in the analysis. These data were collected to examine the potential impact of parent feelings and attitudes upon child externalizing both within the home and outside of the home, as rated by parents and teachers.

The specific data collected and used for the analyses were derived from three separate sources, the Child Behavior Checklist (CBCL; Achenbach, 1991), the Parent

Feelings Questionnaire (PFQ; Deater-Deckard, 1996), and the Parent Attitudes Scale (Deater-Deckard, 1996). Information used from the CBCL consisted of the parent and teacher-reported internalizing and externalizing scales from Year 1 and Year 2 of the WRRP study. The data from the PFQ and Parent Attitudes Scales were also taken from Year 1 and Year 2 of WRRP and was uniquely parental report data. Data from the PFQ and Parent Attitudes Scale sought to assess parental feelings, attitudes toward, and potential differential treatment toward each twin and allows for examination of relationships to that end.

Analyses

Planned Analyses

The analysis plan addressed the four (4) primary study goals stated in the introduction through multiple analytical methods. In order to establish the utility of the data for later analyses, a series of preliminary descriptive statistical analyses was conducted with all of the data. These background preliminary analyses consisted of an examination of the scaling properties and descriptive statistics of the variables used in the TRICSY coding scheme as well as the PARCHISY coding scheme. Specifically, these analyses focused on the descriptive statistics (mean, mode, standard deviation, variance, and range) of the data used in the current study. After examining the data from the preliminary background analyses for any inconsistencies, specific analyses were conducted to address the four primary study goals.

The descriptive statistics of the usable sample (103 families) focused on the scaling properties of the dyadic, triadic, and outcome variables. Specifically, the descriptive statistics related to demographic information such as age, cognitive ability, gender, and parental educational attainment was collected and recorded for use in both the current and later analyses. Additionally, specific child and parent information with regard to cognitive ability and age was collected and analyzed as well.

The measures and variables common to both the dyadic (PARCHISY) and triadic (TRICSY) coding schemes was also analyzed and tabled for use in later analyses. Specifically, the common shared measures were: parent and child observed positive affect, parent and child observed negative affect, observed child responsiveness to parent, observed child non-compliance, parent and child verbalizations, dyadic conflict, dyadic cooperation, and dyadic reciprocity.

Beyond merely examining the demographic and observed variables, data relating to the scale and descriptive properties of the principal outcome measures was collected and analyzed. These analyses were conducted in the same manner as those previously described. The outcome variables examined are the externalizing and internalizing scales from both the parent and teacher-reported sections of the Child Behavior Checklist (Achenbach, 1991), as well as parent-reported positive and negative feeling and attitude measures from the Parent Feelings Questionnaire and the Parent Attitudes Scale (Deater-Deckard, 1996), respectively.

To address the first study goal, to develop and test an observational triadic coding scheme based upon videotaped observations of parents and identical (monozygotic) twins, two specific analyses were carried out. First, analyses of the inter-rater reliability

of the coders for the TRICSY scheme were conducted. The purpose of measuring and analyzing inter-rater reliability within the proposed scheme is to demonstrate a level of consistency, reliability, and agreement among the coders in the observational coding aspects of the current study project. This goal was accomplished by using an alpha based reliability model in SPSS 12.0.

Following the reliability analyses, exploratory factor analysis were also conducted to determine in what manner the sets of variables coded in the TRICSY scheme group together. It was hypothesized that the set of variables coded as part of the proposed triadic observational system and explained in Appendix C, would group into five independent components. The basis of this hypothesis is theoretical in nature and based upon common variable content. The first of the hypothesized components would represent the dyadic variables of reciprocity and cooperation as well as the individually coded variables of positive affect from both the parent and the children. The second hypothesized component would represent the dyadic variable of conflict as well as the individually rated variables of child non-compliance, parent negative affect, and child negative affect. The third hypothesized component would represent the generalized triadic interaction, the comparison measure of triadic interaction, and the individually rated measure of parent verbalization. The final two hypothesized components would represent the opposing constructs of free play positive affect and free play cooperation in one factor and variables of free play conflict and free play negative affect in the fifth hypothesized factor.

The second overall study goal was to examine the correlation of the shared measured variables common to both the PARCHISY and TRICSY coding schemes.

Particular attention was given to the dyadic (parent-child) interpersonal variables measured such as cooperation, conflict, and reciprocity. These analyses were conducted using correlations to investigate the commonality shared by the schemes. The main goal of these correlation analyses was to compare the measures and variables of the PARCHISY and TRICSY schemes. Correlations were conducted to compare the PARCHISY and TRICSY scheme variables with one another, with themselves within scheme and with the assessed outcome variables. The purpose of these analyses was to ascertain the degree and magnitude of the correlations among the coded variables and the measured outcomes.

The third overall study goal was to investigate the relationship between concurrent (Year 1 assessment) parent feelings/attitudes and child behavior problems and the dyadic and triadic scheme observational measures. In particular, the goal was to determine whether the measured triadic constructs predict variability in these socio-emotional and behavioral outcomes beyond the dyadic measures. These analyses were conducted using One-way Analysis of variance (ANOVA) and Multilevel Modeling (MLM) procedures.

The fourth goal was to test the predictive ability of triadic task observations with later (Year 2 assessment) parent and child measured outcomes and variables from the PARCHISY and TRICSY schemes. Similar to the analyses investigating the relationships in the concurrent data, these analyses were conducted utilizing MLM methodologies.

In order to effectively accomplish the analyses set forth in the third and fourth goals, one-way analysis of variance (ANOVA) analyses were conducted with the observational data in order to determine whether there was prediction of the outcomes.

The analyses investigated whether mean group differences in the triadic dominance variables were associated significantly with mean group differences in each of the outcome variables collected.

The variables from the triadic observational data were analyzed and compared with data from the dyadic etch-a-sketch and labyrinth tasks conducted during the same home visit, which had been viewed and coded using the PARCHISY coding scheme previous to the current analyses. The comparison analyses were limited to only those individually measured and dyadic coded variables measured and common to both coding schemes. In addition, the coded data from the TRICSY coding scheme were analyzed with other collected questionnaire data. Specifically, parent feelings and attitude data from the Parent Feelings Questionnaire, (PFQ; Deater-Deckard, 1996) and Parent Attitudes Questionnaire (Deater-Deckard, Petrill & Wilkerson, 2001) were analyzed. These proposed analyses were similar to analyses which had been conducted previously in both adoptive (Deater-Deckard et al., 2001; Deater-Deckard, Smith, Ivy, & Petrill, 2005) and twin data samples (Deater-Deckard, 2000; Knafo & Plomin, 2006).

In addition to conducting the aforementioned one-way ANOVA analyses, post-hoc comparisons in the form of Fisher's Least Significant Difference (LSD) were also conducted. The purpose of the post-hoc procedure was to determine where the differences within a set of means provided by the ANOVA exist.

In addition to the ANOVA analyses the current study also employed Multilevel Modeling (MLM). These analyses were grounded in Hierarchical-Linear Modeling (HLM) and multiple regression procedures. HLM is a multi-level modeling technique that allows researchers to conduct regression analyses while taking into account the

interdependence of data. Analyses were conducted using the statistical program SAS. Specifically, the HLM analyses sought to analyze and examine two questions. The first question investigated through the use of HLM analyses is whether sibling differences in conflict and/or cooperation with the participating parent are predictive of future externalizing problems. The second question analyzed through the proposed HLM analyses is whether child non-compliance in the dyadic interaction predicts future externalizing problems more significantly than non-compliance within the triadic interaction. The results and implications of all of the aforementioned analyses are described in detail in the following results and discussion sections.

In summary, the general goals of the study are to determine whether the triadic observations can be reliably coded and whether they predict concurrent and longitudinal parent and child outcomes better than the dyadic observations.

Chapter 3

RESULTS

As described in the introduction and methods sections, there were four primary study goals to be addressed by means of the proposed analyses. The first goal was to develop and test an observational triadic coding scheme based upon videotaped observations of parents and identical (monozygotic) twins. The second goal was to examine the correlation of the shared measured variables common to both the PARCHISY and TRICSY coding schemes. The third goal was to investigate the

relationship between concurrent (Year 1 assessment) parent feelings/attitudes and child behavior problems and the dyadic and triadic scheme observational measures. The fourth goal was to test the predictive ability of triadic task observations with later (Year 2 assessment) parent and child measured outcomes and variables from the PARCHISY and TRICSY schemes.

These four primary study goals were approached and analyzed by means of six separate sets of analyses. The first set of analyses investigated the overall descriptive statistics and scaling properties of the collected observational data by examining the means, standard deviations, and frequencies of the variables. These background statistical analyses provided the foundation for the subsequent analyses. The second set of analyses was conducted to examine the inter-rater reliability within the TRICSY coding scheme through the analysis of coder ratings. The third set of analyses, exploratory factor analyses, was conducted with the goal of attempting to elucidate the data structure, variable clustering, and variance distribution present within the proposed coding system. The fourth set of analyses was to determine the degree to which the dyadic coded observational data (PARCHISY) variables, triadic coded observational data (TRICSY) variables, and the outcome data correlate with themselves and one another. The fifth set of analyses conducted were to determine if there was a link between the collected triadic dominance observational data and concurrently (Year 1 assessment) and later (Year 2 assessment) collected behavioral, parent feelings, and parent attitudes data with Analysis of Variance (ANOVA). Finally, the sixth set of analyses investigated the interrelation of the measured variables both within and across measurement occasions in order to determine if the TRICSY scheme was more effective than the PARCHISY at predicting

concurrent and future behavioral outcomes with Hierarchal Linear Modeling (HLM). What follows are the results of the proposed analyses grouped by the specific study goal to which they apply.

Background Statistical Analyses

Sample descriptive statistics and frequencies are listed in **Tables 1**, **2**, and **3**. **Table 1** presents the age data for both the participating parents (n = 96) as well as the twin pairs (n =103) coded during the home visit. Of those parents who had provided their birth dates and were videotaped for the current study, there were nearly eight (8) times more mothers (n = 85) than fathers (n = 11) who participated. Overall, the parental sample was approximately 39 years of age (M = 38.99, SD = 5.64). The individual maternal and paternal means (with standard deviations in parentheses) were 39.24 (5.45) and 37.06 (6.92) years of age, respectively.

Also as shown in **Table 1**, there were nearly twice as many girls (132) as boys (74) boys in the observed home visit sample. These children made up the 103 monozygotic (MZ) twin pairs (66 pairs of girls and 37 pairs of boys) analyzed within the current study. The average age of the total twin sample (N = 206) was 6.09 (SD = 0.73) years of age at Year 1 assessment. Daughters and sons were approximately the same average age.

Table 2 shows the frequency and percentage of the various parent-child combinations observed during the coding process. Of the 103 usable and coded parent-twin pair videotapes, 90 videotapes (87%) involved mothers and their twins. The parent-

twin combination frequency from highest to lowest in the sample was mothers with daughters, mothers with sons, fathers with daughters, and fathers with sons.

Table presents the composite general cognitive ability means and standard deviations from the short form Stanford-Binet assessed during both Year 1 and Year 2 of WRRP. The composite scores shown in **Table** are presented for both the total assessed sample as well as for each twin individually for the two years under examination in this particular project. In both Year 1 and Year 2, the samples were just slightly above average and twin scores were not significantly different from one another.

Dyadic (PARCHISY) and Triadic (TRICSY) Descriptive Statistics and Frequencies

The analyses of the observed coded sample were followed up by analyses examining the scaling properties and descriptive statistics of the variables shared by both the PARCHISY and TRICSY observational coding schemes. The results of these analyses are presented in **Table** – Error! Reference source not found..

Table displays the total mean and standard deviation values for the nine (9) coded observational variables common to both coding schemes. **Table** presents the descriptive statistics for the variables from the PARCHISY coding scheme while **Table** Error! Reference source not found. displays the descriptive statistics of the variables from the TRICSY coding scheme. Both **Table** and **Table** Error! Reference source not found. present the statistics from the nine (9) shared variables individually. The nine variables shared by the two schemes are: parent and child positive affect, parent and child negative affect, child responsiveness to the parent, child non-compliance, child

autonomy/independence, parent and child verbalizations, and dyadic measures of conflict, cooperation, and reciprocity.

The total sample available for the PARCHISY coded items was 203 individuals, while the sample for the TRICSY coded items was 206 individuals. The difference in sample size between the two schemes was due to technical videotape and coding issues. All of the described variables for both the PARCHISY and TRICSY schemes were coded on a 7 point categorical scale with 1 indicating the complete absence of the coded behavior in the interaction, 4 indicating presence for about half of the interaction, and 7 indicating consistent presence of the behavior throughout the interaction. As a matter of reference for the variables of positive affect, negative affect, and verbalizations, there was a single, global (one overall parental rating) code for the parental observations in the TRICSY scheme and the values for the PARCHISY scheme were based upon two individual parent-child interaction codes (parent-twin 1, parent-twin 2). What follows is a variable by variable analysis of the background statistical analyses conducted.

Individually Coded Variables

The means for the individually coded variables; positive affect, negative affect, responsiveness, non-compliance, independence/autonomy, and verbalizations are presented in **Table** and **Table** Error! Reference source not found.. The descriptive statistics are presented separately for the PARCHISY and TRICSY schemes. Though the PARCHISY and TRICSY variable means in **Tables** 5 and 6 seem to indicate different

average ratings, there is no significant difference in the ratings between the schemes on average at any level.

Dyadic Conflict, Cooperation and Reciprocity

The dyadic (parent-twin) measures of conflict, cooperation, and reciprocity common to both the dyadic and triadic task coding schemes shown in **Tables 5** and **6** illustrated results similar to those found in the individually coded variables. There were no significant mean differences found within or between the task coding schemes for the shared dyadic level variables common to both schemes.

Outcome Variable Descriptive Statistics

The preliminary analyses of the variables shared by both the dyadic and triadic coding schemes were followed up by analyses examining the scaling properties and descriptive statistics of the outcome variables. The results from the analyses involving variables from the Parent Feelings Questionnaire are presented in **Table** -Error! Reference source not found., results from the Parent Attitudes Questionnaire variables are presented in **Tables** Error! Reference source not found.**-14**, and **Table 15** presents the results from analyses with the Child Behavior Checklist scales. These results are described separately by assessment instrument in detail as follows.

Parent Feelings Questionnaire Descriptive Statistics

Table shows the overall descriptive statistics of the Parent Feelings Questionnaire (PFQ) as collected for Years 1 and 2 of WRRP are displayed. **Tables** Error! Reference source not found. and Error! Reference source not found. present additional descriptive statistics from the PFQ by further breaking down the data by parent sex and parent-child configuration, respectively. In **Table** Error! Reference source not found., the breakdown of the PFQ descriptive data by both parent sex and individual child is displayed. None of the values presented in **Table 7** for positive parental feelings (PosA) or negative parental feelings (NegA) exhibit any significant mean differences from Year 1 to Year 2, either by child or by time of assessment. Also, there were also no significant mean differences between mothers and fathers in their reporting of positive or negative feelings toward their twins as shown in **Table** Error! Reference source not found.. In addition, concordance or discordance of sex among the participating parent and twin pairs had no significant impact upon the mean reported positive or negative parent feelings, as presented in **Table** Error! Reference source not found.. Finally, based upon the information exhibited in **Table** Error! Reference source not found., there was no evidence of significant differential mean reported positive or negative feelings by the parents toward the twins based upon the parent's sex.

Parent Attitudes Questionnaire Descriptive Statistics

Tables Error! Reference source not found.-Error! Reference source not found. display the descriptive statistics from the outcome variables collected from the Parent

Attitudes Questionnaire. **Table** Error! Reference source not found. displays the overall sample descriptive statistics. In **Tables** Error! Reference source not found. and Error! Reference source not found. the Parent Attitudes Questionnaire descriptive data is provided and broken down by parent sex and parent-child configuration. **Table** Error! Reference source not found. presents the Parent Attitude Questionnaire variables separated by both parent sex and child together. Similar to the data from the PFQ, the means for the positive attitude scales (Year 1 PosB, Year 2 PosB) and the scales for negativity (Year 1 NegB, Year 2 NegB) exhibit no significant mean differences. There were also no significant differences found for differential parental attitude by parent sex.

Child Behavior Checklist Descriptive Statistics

Table Error! Reference source not found. shows descriptive statistics for the parent and teacher-reported Externalizing and Internalizing scales as calculated from the Child Behavior Checklist (CBCL) and collected from the Year 1 and Year 2 assessment questionnaires of WRRP. The parent and teacher ratings of child externalizing and internalizing behavior were both relatively correlated across both child and measurement occasion. As seen in **Table** Error! Reference source not found., both parent and teacher rated scales for child externalizing and internalizing are not significantly different in mean values for twin 1 and twin 2 between assessment time points or between source of the report (parent or teacher).

Study Goal 1: Development and testing of an observational triadic coding system

Following the preliminary analyses, analyses directly pertinent to the primary study goals and hypotheses were conducted. The initial set of analyses conducted was inter-rater reliability analyses. Analyses of inter-rater reliability were conducted on 19 videotapes chosen at random from the pool of videotapes each coder was responsible for coding. These videotapes were coded by all four coders and entered into an SPSS database for reliability analyses using an alpha reliability model. The results of the reliability analyses are broken down and presented in three separate tables, **Tables** Error! Reference source not found., Error! Reference source not found. and Error! Reference source not found.. **Table** Error! Reference source not found. presents the reliability statistics for the individual level variables. **Table** Error! Reference source not found. exhibits the alpha statistics for the dyadic and triadic assessed variables. **Table** Error! Reference source not found. shows the alpha statistics for the sample of families who participated in "Free Play" after the triadic task had concluded.

With respect to the results, the majority of the coded variables had alpha statistics near or above .70. In fact, of the 33 variables analyzed and coded by all four of the coders, only 4 (Twin 2 autonomy, Twin 1-Twin 2 reciprocity, Twin 1-parent reciprocity, and "Free Play" Positive Affect) had alpha statistics below .60. As evidenced in **Table** Error! Reference source not found., the range of alphas for the individually assessed items was between .60 and .92.

Table Error! Reference source not found. presents the reliability statistics for the dyadic and triadic level coded variables. The dyadic conflict (α = .70-.90), cooperation

(α = .66-.74), and the triadic dominance and cooperation vs. conflict rating variables (α = .86-.91) all had reliabilities that were similar in range.

The variables rated for dyadic reciprocity were the least consistent in the range of alphas collected. The alphas of .59 for the twin 1-twin 2 dyad, .29 (.47 for 3 coders) for the twin 1-parent dyad, and .69 for the twin 2-parent dyad demonstrate the wide variation in this area. The reliability issues of this particular variable will be addressed more fully in the discussion section.

Finally, **Table** Error! Reference source not found. presents the "Free Play" variables from a sample of eight (8) videotapes within which the participating triads engaged in unstructured interaction following completion of the triadic domino task. The alpha statistics from these analyses ranged from .48 for sibling positive affect to .95 for sibling conflict. Though these variables were only coded for sibling interaction, they were relatively consistent.

In addition to the examination of inter-rater reliability within the proposed coding scheme, exploratory factor analyses were also conducted with the triadic task data. These analyses were conducted to elucidate how the collected variables within the TRICSY scheme would cluster and explain variance. The variables from the TRISCY scheme were run through the FACTOR command of SPSS with Principal Component Analysis as the method of extraction and with Varimax Rotation. The results of these analyses are presented in **Table** Error! Reference source not found., in the form of the supplied rotated component matrix, which converged in 11 iterations. Information taken from the Scree plot in Figure **4** and Eigenvalue table shown in **Table** Error! Reference source not found.

indicated that there were seven components with Eigenvalues above the 1.0 threshold and those components accounted for 81.38% of the variance.

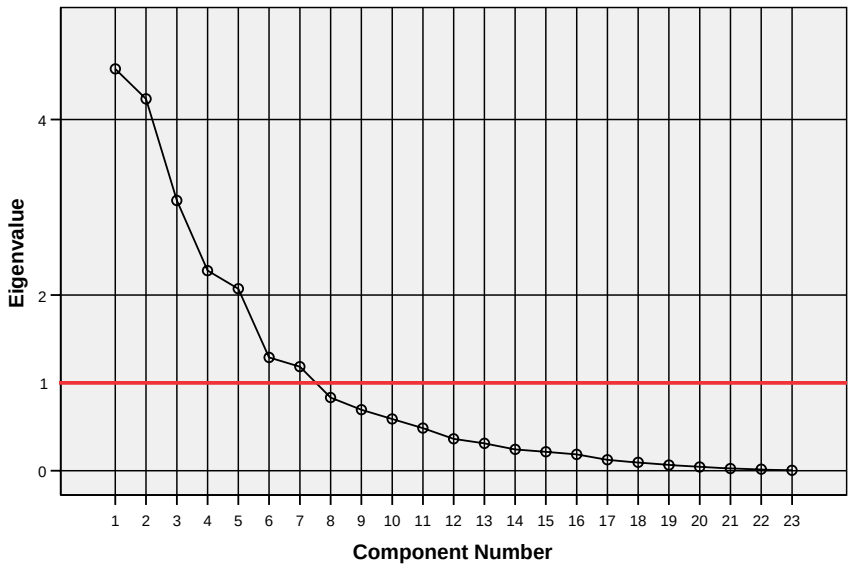

Figure 4: **Scree Plot.** Components and Eigenvalues from exploratory factor analysis.

The seven major components (Eigenvalue $\geq$ 1.0 and factor loading $\geq$ 0.25) are presented in **Table** Error! Reference source not found.. **Table** Error! Reference source not found. aggregates the components with the variables which compose them and their corresponding variable factor loadings.

The first component is comprised of four variables (parent positive affect, parent-child reciprocity, child positive affect, and child verbalizations).This component seems to tap into the positive affective aspects of the overall interaction. Though child verbalizations does have a cross loading with the second component, it is more strongly connected with the first component. The only other variables with feasible loadings are child-parent cooperation and parent verbalizations. Parent verbalizations are more

strongly loaded on the third component and child-parent cooperation is relatively evenly split in loading on the first and fourth components.

The second component is made up of four variables (child non-compliance, child responsiveness, child-parent conflict, and child negative affect. This component is primarily composed of the negative, disruptive aspects of the interaction. The child-child conflict loading is pretty evenly cross loaded with components four and five but is most closely associated with the fourth component.

The third component is a four variable component made up of parent negative affect, child autonomy, parent verbalizations, and child-child reciprocity. The component has fairly consistent variable loadings. Parent negative affect and parent verbalizations have negative factor loadings and child autonomy and child-child reciprocity have positive loading values. This component is composed of elements related to parental influence on the task.

The fourth component displayed in the matrix is a four variable component composed of “Free Play” dominance, child-parent cooperation, child-child cooperation, and child-child conflict. Three variables have positive factor loadings and child-child conflict has a negative factor loading. The first three variables all load on the component highly and child-child conflict loads more moderately. This component is centered on the cooperative interpersonal interaction elements of the triadic task.

The fifth component includes the “Free Play” cooperation and “Free Play” positive affect variables. The positive aspects within the “Free Play” sibling interactions are accentuated by this component.

The sixth component is comprised of the triad-specific variables of interaction conflict vs. cooperation rating, the general sibling-parent dominance variable, and the comparative sibling-parent dominance variable. These are all of the variables which were specifically created for the triadic task and scheme. This component is solely composed of ratings and variables assessing the quality and control aspects of the triadic interaction.

The seventh and final component identified with an Eigenvalue greater than 1.0 is composed of the "Free Play" conflict and "Free Play" negative affect variables. This final component has to do singularly with the negative aspects of the "Free Play" sibling interaction.

The seven component structure seen in the analyses follows the general thematic expectations described in the methods section, though there are some differences in how the variables clustered into the components. These results and their implications are explored further in the discussion section.

Study Goal 2: Examine the correlation of the shared PARCHISY and TRICSY variables

The next sets of analyses conducted were correlation analyses. The purpose of these analyses was to examine the extent of the relationship between the variables shared by the PARCHISY and TRICSY. The correlation analyses examined the relationships among the variables in a number of ways and are presented in **Tables** Error! Reference source not found.-Error! Reference source not found.. **Table** Error! Reference source not found. shows the results of the analyses involving the variables shared by the PARCHISY and TRICSY coding schemes. Next, analyses to examine the relationship of

the coding scheme variables separately with one another within the PARCHISY (**Table** Error! Reference source not found.) and TRICSY (**Table** Error! Reference source not found.) coding schemes were conducted. Additionally, correlation analyses were conducted with the outcome variables across years of assessment (Year 1 x Year 2). The results of these outcome variable correlations are presented in **Table** Error! Reference source not found.. The final group of correlation analyses conducted investigated the relationships between the PARCHISY (**Tables** Error! Reference source not found. and Error! Reference source not found.) and TRICSY (**Tables** Error! Reference source not found. and Error! Reference source not found.) coded variables and the outcome variables by year of assessment. In depth descriptions of each analysis is provided below.

The correlations displayed in **Table** Error! Reference source not found. represent the relationship among the variables measured by both the PARCHISY and TRISCY coding schemes. The Pearson coefficients of the shared variables range from .06 to .34. The three variables with the lowest coefficients (child verbalizations, dyadic reciprocity, and dyadic cooperation) were also the variables not significantly correlated between the two coding schemes. Those variables with coefficients greater than .10 but less than .20 were significantly correlated at the $p < .05$ level. The variables which met this threshold included child positive affect, child negative affect, child responsiveness, and child independence/autonomy. The remaining variables (parent positive affect, parent negative affect, child non-compliance, parent verbalizations, and dyadic conflict) had Pearson coefficients above .20 and were significantly correlated at the $p < .01$ level, as seen in **Table** Error! Reference source not found..

The correlation matrices presented in **Tables** Error! Reference source not found. and Error! Reference source not found. display the variable by variable inter-correlations separately within the PARCHISY and TRISCY coding schemes. These correlations include the twelve (12) shared variables seen in both coding schemes.

Of note, the results presented in **Table** Error! Reference source not found. exhibit numerous significant correlations. Within the matrix of inter-correlations of the PARCHISY scheme variables, there was a number with moderately significant relationships. The measures of dyadic conflict, cooperation, and reciprocity were all significantly correlated with a number of variables individually. Dyadic conflict was significantly correlated with parent and child negative affect as well as child non-compliance. Dyadic cooperation was correlated significantly with parent positive affect and dyadic reciprocity. Dyadic reciprocity was correlated significantly with child and parent positive affect.

Other significant correlations in the PARCHISY matrix included child positive affect with parent positive affect, parent negative affect with child non-compliance, and child independence/autonomy with child verbalizations. Though the aforementioned correlations were not the only significant relationships present in the matrix, they do represent the most significant inter-correlations in terms of magnitude.

The correlation matrix presented in **Table** Error! Reference source not found., which are the results from the variable inter-correlations within the TRICSY coding scheme, are quite similar to those reported from the PARCHISY scheme. Of particular interest in **Table** Error! Reference source not found. is a set of results which included the variables of child non-compliance, child independence/autonomy, and child

verbalizations variables all presenting near zero correlations with one another. In addition, these variables also had near zero correlations with both the child and parent measures of negative affect. These sets of correlations appear as a block of non-significant coefficients within the correlation matrix presented in **Table** Error! Reference source not found..

Furthermore, the variables of child verbalizations, child independence/autonomy, and parent verbalizations also showed near zero correlations with the measure of dyadic conflict. With the exception of these stated variable pairings, all of the other variables in the TRICSY coding scheme correlated significantly with one another at least at the $p < .05$ level, with the majority correlated at the $p < .01$ level.

Table Error! Reference source not found. shows the results of the correlation analyses between the Year 1 assessment outcome variables and the Year 2 assessment outcome variables. All of the outcome variables correlate significantly across assessment occasions at the $p < .01$ level. All of the outcome variables of interest are substantially stable ($r > .55$) except for teacher-rated child internalizing which is moderately stable ($r = .35$, $p < .01$).

Tables Error! Reference source not found.-Error! Reference source not found. take the previous analyses one step further by showing the correlation results of the PARCHISY coded variables (**Tables** Error! Reference source not found. and Error! Reference source not found.) and TRICSY coded variables (**Tables** Error! Reference source not found. and Error! Reference source not found.) with the outcome variables of interest by year of assessment. **Table** Error! Reference source not found. shows PARCHISY by Year 1 outcome correlations, **Table** Error! Reference source not found.

displays PARCHISY with Year 2 outcome variables, **Table** Error! Reference source not found. presents TRICSY by Year 1 outcomes, and **Table** Error! Reference source not found. gives the results of TRICSY and the Year 2 outcomes.

As can be observed from **Table** Error! Reference source not found., there are only four (4) significant correlations between the PARCHISY variables and the Year 1 outcome variables: child positive affect with parent negative feelings, parent negative affect with parent-rated child internalizing, parent negative affect with teacher-rated child externalizing, and child non-compliance with teacher-rated child externalizing.

The results from **Table** Error! Reference source not found., examining the PARCHISY variable correlations with the assessed Year 2 outcomes, are quite similar to those seen in **Table** Error! Reference source not found.. In fact, three significant correlations that were present between the PARCHISY variables and the Year 1 outcomes are present with the Year 2 data in addition to two more unique statistically significant correlations. The correlation between parent negative affect and parent rated child internalizing was close in magnitude to what was observed with the Year 1 data. As was observed with the Year 1 data, parent negative affect was correlated significantly, at the $p < .01$ level, with teacher rated child externalizing. The third correlation common to both Year 1 and Year 2 analyses was the correlation between child non-compliance and teacher rated child externalizing ($r = .18$), though the significance level for the Year 2 outcome is only at the $p < .05$ level. Two additional correlations not seen in **Table** Error! Reference source not found. also appeared in the Year 2 data. The first unique significant correlation appeared between child negative affect and teacher-reported child

externalizing (r = .28, p < .01). The second unique significant correlation was in relation to child non-compliance and teacher-reported child internalizing (r = -.18, p < .05).

The TRICSY variable by outcome variable correlation analysis results are presented in **Tables** Error! Reference source not found. and Error! Reference source not found.. These results reveal that there are more significant correlations with the outcome variables than were present in the PARCHISY correlation matrices. In **Table** Error! Reference source not found., presenting the results of the analyses with the TRICSY system and the Year 1 outcomes, there are 16 significant correlations. As was the case with the PARCHISY, the Pearson coefficients are low. Parent rated child externalizing was significantly correlated, at the p < .01 level, with both child independence/autonomy and dyadic conflict. Teacher rated child externalizing was the Year 1 outcome variable with the most correlations (7) with the TRICSY variables. Externalizing behavior correlated with child and parent negative affect, child non-compliance, child independence/autonomy, child verbalizations, dyadic reciprocity, and dyadic conflict. Teacher rated child internalizing correlated with child independence/autonomy and child verbalizations, both at the p < .05 level. Parent negative feelings significantly correlated with dyadic conflict. Parent positive attitudes was negatively correlated with parent verbalizations while parent negative attitudes was positively correlated with child independence/autonomy and dyadic conflict and negatively correlated with dyadic cooperation.

In **Table** Error! Reference source not found., there are seven significant correlations that are present in both the Year 1 outcomes and the Year 2 outcomes and four significant correlations present in the Year 2 correlation matrix that were not present

with the Year 1 variables. The five significant correlations with teacher-reported child externalizing are all correlations that were present with the Year 1 data. The four unique significant correlations, significant at the $p < .05$ level, that are to the Year 2 outcome matrix are parent rated child externalizing and dyadic cooperation, parent negative feelings and child verbalizations, parent negative feelings and dyadic reciprocity, and parent negative attitudes dyadic reciprocity.

Study Goal 3: Investigate the relationship between concurrent (Year 1 assessment) parent feelings/attitudes and child behavior problems and the dyadic and triadic scheme observational measures

Presented in **Tables** Error! Reference source not found., **Table** , and Error! Reference source not found. are three separate sets of one-way analysis of variance (ANOVA) results conducted with the data from the current study. Specifically, **Table** Error! Reference source not found. presents the results of analyses examining the relationship between each triadic dominance variable (general and comparison) and the sibling difference scores for the Year 1 assessment outcome variables. **Table** presents the results of a similar analysis using only the Year 2 assessments instead of Year 1. **Table** Error! Reference source not found. shows the results of the one-way ANOVA utilizing all of the TRICSY variables (with the exception of the triadic variables) coded by the raters. The particular outcome variables examined in these analyses were parent rated child externalizing and internalizing, teacher rated child externalizing and internalizing, positive and negative parent feelings, and positive and negative parent attitudes. Both of the triadic dominance variables had three categories. The three general

triadic dominance variable categories consisted of those interactions in which twin 1 was dominant in comparison to twin 2, interactions in which twin 2 was dominant in comparison to twin 1, and interactions in which both twins were equally dominant as compared to one another. The comparative triadic dominance variable was broken down into categories with interactions in which the twins were dominant as compared to the parent, interactions in which the parent was dominant over the twins, and interactions in which the twins and parent were equally dominant. In the current study we were interested in whether there are significant differences in the outcome variables of interest and the other coded TRICSY variables, based upon how the families were coded and categorized on each of the two triadic dominance variables assessed. If significant differences were found for any of the analyzed variables, post-hoc Fisher's Least Significant Difference (LSD) tests were conducted to determine precisely where the significant differences existed.

As can be seen in both **Tables** Error! Reference source not found. and **Table** , there were no significant mean differences between the outcome differences and the two dominance variables coded and assessed within the TRICSY scheme. This result holds true for all of the measured outcome variables assessed in both Year 1 and Year 2 of WRRP.

Differences emerged in other assessed variables within the triadic coding scheme. As is seen in **Table** Error! Reference source not found., there are significant mean group differences in all of the assessed TRICSY variables except for child positive affect and dyadic conflict. All of the results summarized below were determined through post-hoc testing using Fisher's LSD test upon the establishment of a significant omnibus F-test.

TRICSY Variable Difference Scores by Triadic Dominance Measure Analyses

Analysis and examination of the TRICSY variable sibling difference scores by the triadic dominance variables revealed numerous significant results. The parent positive affect variable revealed significant mean group differences between the group in which twin 1 dominated the task and the group where both children dominated the task equally. Both parent and child negative affect difference score analyses found significant group mean differences between the groups where both children dominated equally and the groups where twin 1 or twin 2 dominated alone. Analyses of child responsiveness, child non-compliance, child independence/autonomy, parent verbalizations, and dyadic reciprocity and cooperation difference scores each found that significant group means existed between the group where twin 2 dominated and groups where twin 1 dominated or both twins dominated equally compared to one another. Significant group mean differences were found through analysis of the child verbalization difference scores by the general triadic dominance variable. The significant difference found was between the group where twin 1 dominated the task and the groups where twin 2 dominated or the twins dominated equally.

Additionally, significant group mean differences were discovered through examination of the child independence/autonomy difference score in relation to the comparative measure of sibling-parent dominance. The post-hoc results revealed that the group where the twins dominated the task more than the parent was significantly different in group mean compared to the groups where the parent dominated the task and the twins and parent dominated the task equally compared to each other.

Study Goal 4: Test the predictive ability of triadic task observations with later (Year 2 assessment) parent and child measured outcomes and variables from the PARCHISY and TRICSY schemes

One of the key goals of the current study was to examine whether aspects of triadic interaction predict behavioral outcomes, particularly externalizing, in the participant children, and to do so better than aspects of dyadic interaction. To investigate these relationships while controlling for the structure of the data, Multi-Level Modeling (MLM) (Snijders & Bosker, 1999) using SAS Proc Mixed was employed. Specifically, four models, the intercept and three sub-models, were examined to test the extent to which the selected constructs accounted for significant variance in the behavioral outcomes. The variables chosen (dyadic conflict, dyadic cooperation, and child non-compliance) were measured and collected in each coding scheme. As shown in **Tables** Error! Reference source not found., Error! Reference source not found., and Error! Reference source not found., each analysis began with a base intercept model, then the PARCHISY variable was added to the model, followed by the TRICSY variable, and finally a term for the PARCHISY x TRICSY interaction. Chi-square change, degree of freedom change, and the significance of the model fit are included for each tested model. MLM, particularly the Hierarchical Linear Modeling (HLM) techniques used in this study were employed to account for the nested and non-independent nature of the data with twin children within the same family. These HLM analyses were based upon a sample of 206 children nested within 103 families.

The aim of the analyses is to examine two basic questions posed by the study hypotheses. The first question and models tested was whether sibling differences in

conflict and/or cooperation with the participating parent predicted concurrent and/or future externalizing behaviors. The second question and model tested was whether child non-compliance in the triadic interaction predicted future externalizing problems better than non-compliance in the dyadic interaction.

The first set of analyses presented in **Table** Error! Reference source not found., examined the relationship between conflict difference scores and their ability to predict concurrent (Year 1 assessment) and future (Year 2 assessment) externalizing behaviors. The base intercept model for concurrent externalizing behavior had a -2 Log Likelihood (-2ll) statistic of -257.8. When the dyadic conflict difference score was added to the model, the -2ll remained unchanged; an indication of no change in model fit. The next model tested added the triadic measure to the model. This addition to the model produced a -2ll of -263.7, showing no significant improvement in model fit. Finally, the interaction term of the dyadic by triadic (Dyad*Triad) was added to the model and did not significantly improve fit.

Similar results were found for associations between conflict difference scores and the Year 2 assessments of externalizing behavior. The model with the dyadic scheme variable (-2ll = -215.1) did not differ in model fit from the base model. There were no significant changes in model fit with the addition of the triadic measure or the interaction term added, as shown in **Table** Error! Reference source not found.. Therefore, there were no significant differences found between using the dyadic interaction and the triadic interaction coding systems' conflict difference scores in the prediction of concurrent or future externalizing behavior, as evidenced in **Table** Error! Reference source not found..

Additionally, as shown in **Table** Error! Reference source not found. there were no significant differences revealed in the use of the dyadic interaction and triadic coding schemes' parent-child cooperation difference scores in predicting concurrent and future externalizing behavior in participant children. In the concurrent externalizing behavior analyses, none of the models yielded significant improvement in model fit over the base intercept model (-2ll = -257.8). The results of the later (Year 2) assessed externalizing behavior also showed non-significant results as illustrated in **Table** Error! Reference source not found..

Analyses related to the second question concerning whether child non-compliance in the triadic interaction predicted future externalizing problems better than non-compliance in the dyadic interaction produced no significant difference in the coding schemes' non-compliance difference scores in the prediction of concurrent or future externalizing behavior. The results from the analysis of the concurrent externalizing behavior did not provide significant results for model fit. The base model had a -2ll of -257.8. The addition of the dyadic scheme variable provided a -2ll of -261.5 and a Chi-square change of 3.7 units, a marginally non-significant change with 1 degree of freedom change. Similarly, as shown in **Table** Error! Reference source not found., the Chi-square change for the addition of the triadic (5.1) and interaction terms (7.4) were also marginally close to the threshold of significance. In the analyses of the Year 2 assessments, all of the sub-models examined provided an improved model fit though none of the models were significantly better than the others or the base intercept model.

Table **1**: Age related descriptive statistics of participating parents and children.

Subjects	N	Mean	SD	Range
Parents				
Parent sample	96	38.99	5.64	35.62
Mothers	85	39.24	5.45	33.72
Fathers	11	37.06	6.92	23.62
Children				
Twin sample	206	6.09	0.73	2.92
Daughters	132	6.08	0.75	2.92
Sons	74	6.09	0.69	2.58

Note. Sample is out of maximum 103 parents and 206 children.

Table **2**: Parent-child configurations.

Configuration	Frequency	Valid Percentage of Sample
Mother-2 sons	36	35.0
Father-2 sons	1	1.0
Mother-2 daughters	54	52.4
Father-2 daughters	12	11.7
Mothers	90	87.4
Fathers	13	12.6
Sons	74	35.9
Daughters	132	64.1

Table **3**: Child Stanford-Binet composite score descriptive statistics.

Subjects	N	Stanford-Binet Mean	SD
Year 1			
Child Sample	192	101.11	13.86
Twin 1	95	100.98	13.97
Twin 2	97	101.25	13.82
Year 2			
Child Sample	174	102.29	12.74
Twin 1	87	102.57	12.36
Twin 2	87	102.00	13.18

Table **4**: Descriptive data on variables coded in both the PARCHISY and TRICSY.

Variable	N	Mean	SD
Positive Affect			
PARCHISY Child	203	2.91	0.87
TRICSY Child	206	3.34	1.17
PARCHISY Parent	203	2.85	0.77
TRICSY Parent	206	3.56	1.18
Negative Affect			
PARCHISY Child	203	1.22	0.41
TRICSY Child	206	2.54	1.01
PARCHISY Parent	203	1.19	0.49
TRICSY Parent	206	2.33	1.11
Responsiveness			
PARCHISY Child	203	5.38	0.95
TRICSY Child	206	5.05	0.96
Non-Compliance			
PARCHISY Child	203	1.20	0.45
TRICSY Child	206	2.17	1.06
Independence			
PARCHISY Child	203	1.97	0.84
TRICSY Child	206	1.79	0.84
Verbalizations			
PARCHISY Child	203	3.37	0.70
TRICSY Child	206	3.95	1.04
PARCHISY Parent	203	4.86	0.95
TRICSY Parent	206	5.46	0.86
Conflict			
PARCHISY Child	203	1.07	0.23
TRICSY Child	206	2.30	1.10
Cooperation			
PARCHISY Child	203	2.24	1.26
TRICSY Child	206	3.95	1.20
Reciprocity			
PARCHISY Child	203	2.57	1.19
TRICSY Child	206	3.69	1.06

Note. Variables are coded on 7 point scale (1= complete absence of the coded behavior in the interaction, 4= presence for about half of the interaction, 7= constant presence of the behavior)

Table **5**: Descriptive data on variables coded in the PARCHISY sample.

Variable	N	Mean	SD
Positive Affect			
Child 1	100	2.97	0.77
Child 2	103	2.85	0.96
Parent C1	100	3.01	0.70
Parent C2	103	2.69	0.81
Negative Affect			
Child 1	100	1.19	0.35
Child 2	103	1.24	0.46
Parent C1	100	1.09	0.23
Parent C2	103	1.29	0.64
Responsiveness			
Child 1	100	5.47	1.03
Child 2	103	5.29	0.86
Non-Compliance			
Child 1	100	1.16	0.35
Child 2	103	1.25	0.53
Independence			
Child 1	100	2.10	0.97
Child 2	103	1.84	0.68
Verbalizations			
Child 1	100	3.39	0.65
Child 2	103	3.35	0.75
Parent C1	100	4.81	0.85
Parent C2	103	4.92	1.05
Conflict			
Child 1	100	1.05	0.16
Child 2	103	1.10	0.28
Cooperation			
Child 1	100	2.26	1.16
Child 2	103	2.23	1.36
Reciprocity			
Child 1	100	2.59	1.06
Child 2	103	2.55	1.31

Note. Variables are coded on 7 point scale (1= complete absence of the coded behavior in the interaction, 4= presence for about half of the interaction, 7= constant presence of the behavior)

Table **6**: Descriptive data on variables coded in the TRICSY sample.

Variable	N	Mean	SD
Positive Affect			
Child 1	103	3.32	1.21
Child 2	103	3.35	1.14
Parent	103	3.56	1.18
Negative Affect			
Child 1	103	2.68	1.13
Child 2	103	2.40	0.86
Parent	103	2.33	1.11
Responsiveness			
Child 1	103	4.92	1.06
Child 2	103	5.17	0.83
Non-Compliance			
Child 1	103	2.30	1.20
Child 2	103	2.05	0.89
Independence			
Child 1	103	1.88	0.89
Child 2	103	1.69	0.78
Verbalizations			
Child 1	103	3.93	1.02
Child 2	103	3.96	1.06
Parent	103	5.46	0.86
Conflict			
Child 1	103	2.30	1.10
Child 2	103	2.04	0.97
Cooperation			
Child 1	103	3.95	1.21
Child 2	103	4.02	1.18
Reciprocity			
Child 1	103	3.69	1.07
Child 2	103	3.71	1.09

Note. Variables are coded on 7 point scale (1= complete absence of the coded behavior in the interaction, 4= presence for about half of the interaction, 7= constant presence of the behavior)

Table **7**: Descriptive data on variables coded from the Parent Feelings Questionnaire (PFQ).

Variable	N	Mean	SD
Year 1 PosA	179	45.97	2.72
Child 1	90	45.88	2.99
Child 2	89	46.07	2.43
Year 2 PosA	172	46.07	2.64
Child 1	86	46.01	2.78
Child 2	86	46.13	2.51
Year 1 NegA	179	30.59	10.40
Child 1	90	31.60	9.60
Child 2	89	29.56	11.10
Year 2 NegA	172	26.07	10.51
Child 1	86	28.69	10.52
Child 2	86	27.45	10.53

Table **8**: Descriptive data on variables coded from the Parent Feelings Questionnaire (PFQ) by parent sex.

Variable	N	Mean	SD
Year 1 PosA	179	45.97	2.72
Mother	166	46.08	2.60
Father	13	44.56	3.82
Year 2 PosA	172	46.07	2.64
Mother	154	46.17	2.63
Father	18	45.22	2.60
Year 1 NegA	179	30.59	10.40
Mother	166	30.73	10.39
Father	13	28.70	10.69
Year 2 NegA	172	26.07	10.51
Mother	154	28.76	10.76
Father	18	22.16	5.25

Table **9**: Descriptive data on variables coded from the Parent Feelings Questionnaire (PFQ) by parent-child configuration.

Variable	N	Mean	SD
Year 1 PosA	179	45.97	2.72
Mother-2 sons	68	45.84	2.67
Mother-2 daughters	98	46.25	2.55
Father-2 daughters	13	44.56	3.82
Year 2 PosA	172	46.07	2.64
Mother-2 sons	64	46.19	2.66
Mother-2 daughters	90	46.16	2.63
Father-2 daughters	18	45.22	2.60
Year 1 NegA	179	30.59	10.40
Mother-2 sons	68	31.56	9.69
Mother-2 daughters	98	30.16	10.86
Father-2 daughters	13	28.70	10.69
Year 2 NegA	172	26.07	10.51
Mother-2 sons	64	29.19	12.00
Mother-2 daughters	90	28.45	9.85
Father-2 daughters	18	22.17	5.25

Table **10**: Descriptive data on variables coded from the Parent Feelings Questionnaire (PFQ) by parent sex and child.

Variable	N	Mean	SD
Year 1 PosA	179	45.97	2.72
Mother Child 1	83	46.01	2.85
Father Child 1	7	44.29	4.31
Mother Child 2	83	46.15	2.34
Father Child 2	6	44.88	3.53
Year 2 PosA	172	46.07	2.64
Mother Child 1	77	46.06	2.78
Father Child 1	9	45.56	2.83
Mother Child 2	77	46.27	2.49
Father Child 2	9	44.89	2.47
Year 1 NegA	179	30.59	10.40
Mother Child 1	83	31.54	9.56
Father Child 1	7	32.29	10.92
Mother Child 2	83	29.92	11.16
Father Child 2	6	24.51	9.61
Year 2 NegA	172	26.07	10.51
Mother Child 1	77	29.35	10.76
Father Child 1	9	23.00	5.20
Mother Child 2	77	28.16	10.76
Father Child 2	9	21.33	5.48

Table **11**: Descriptive data on variables coded from the Parent Attitudes Questionnaire.

Variable	N	Mean	SD
Year 1 PosB	179	44.26	4.26
Child 1	90	44.02	4.33
Child 2	89	44.51	4.20
Year 2 PosB	172	44.33	4.67
Child 1	86	43.88	4.68
Child 2	86	44.77	4.65
Year 1 NegB	179	12.49	4.52
Child 1	90	13.07	4.93
Child 2	89	11.90	3.99
Year 2 NegB	172	12.45	5.53
Child 1	86	12.62	5.18
Child 2	86	12.28	5.87

Table **12**: Descriptive data on variables coded from the Parent Attitudes Questionnaire by parent sex.

Variable	N	Mean	SD
Year 1 PosB	179	44.26	4.26
Mother	166	44.34	4.15
Father	13	43.31	5.65
Year 2 PosB	172	44.33	4.67
Mother	154	44.21	4.74
Father	18	45.33	4.04
Year 1 NegB	179	12.49	4.52
Mother	166	12.65	4.52
Father	13	10.38	3.97
Year 2 NegB	172	12.45	5.53
Mother	154	12.72	5.65
Father	18	10.17	3.67

Table **13**: Descriptive data on variables coded from the Parent Attitudes Questionnaire by parent-child configuration.

Variable	N	Mean	SD
Year 1 PosB	179	44.26	4.26
Mother-2 sons	68	43.44	4.97
Mother-2 daughters	98	44.96	3.35
Father-2 daughters	13	43.31	5.65
Year 2 PosB	172	44.33	4.67
Mother-2 sons	64	43.95	4.84
Mother-2 daughters	90	44.39	4.68
Father-2 daughters	18	45.33	4.04
Year 1 NegB	179	12.49	4.52
Mother-2 sons	68	13.29	4.94
Mother-2 daughters	98	12.20	4.18
Father-2 daughters	13	10.38	3.97
Year 2 NegB	172	12.45	5.53
Mother-2 sons	64	12.13	4.84
Mother-2 daughters	90	13.14	6.16
Father-2 daughters	18	10.17	3.67

Table **14**: Descriptive data on variables coded from the Parent Attitudes Questionnaire by parent sex and child.

Variable	N	Mean	SD
Year 1 PosB	179	44.26	4.26
Mother Child 1	83	44.14	4.17
Father Child 1	7	42.57	6.11
Mother Child 2	83	44.53	4.13
Father Child 2	6	44.17	5.49
Year 2 PosB	172	44.33	4.67
Mother Child 1	77	43.81	4.77
Father Child 1	9	44.56	4.03
Mother Child 2	77	44.61	4.70
Father Child 2	9	46.11	4.14
Year 1 NegB	179	12.49	4.52
Mother Child 1	83	13.25	4.95
Father Child 1	7	10.86	4.38
Mother Child 2	83	12.05	3.99
Father Child 2	6	9.83	3.76
Year 2 NegB	172	12.45	5.53
Mother Child 1	77	12.81	5.32
Father Child 1	9	11.00	3.71
Mother Child 2	77	12.62	6.00
Father Child 2	9	9.33	3.64

Table **15**: Child Behavior Checklist (CBCL) descriptive statistics.

Variable	N	Mean	SD
Externalizing			
Year 1 Parent	179	0.20	0.16
Child 1	90	0.21	0.16
Child 2	89	0.18	0.16
Year 2 Parent	172	0.18	0.14
Child 1	86	0.20	0.15
Child 2	86	0.16	0.14
Year 1 Teacher	178	0.09	0.18
Child 1	89	0.10	0.19
Child 2	89	0.10	0.12
Year 2 Teacher	139	0.08	0.15
Child 1	69	0.07	0.13
Child 2	70	0.08	0.16
Internalizing			
Year 1 Parent	179	0.14	0.14
Child 1	90	0.16	0.16
Child 2	89	0.13	0.12
Year 2 Parent	172	0.11	0.14
Child 1	86	0.15	0.15
Child 2	86	0.12	0.12
Year 1 Teacher	178	0.14	0.13
Child 1	89	0.08	0.16
Child 2	89	0.12	0.14
Year 2 Teacher	139	0.09	0.11
Child 1	69	0.09	0.12
Child 2	70	0.09	0.11

Table **16**: Inter-rater reliability statistics for TRICSY (Individual level variables).

Measure	Cronbach's Alpha
Individual Level	
Positive Affect Child 1	.80
Positive Affect Child 2	.81
Positive Affect Parent	.72
Negative Affect Child 1	.84
Negative Affect Child 2	.69
Negative Affect Parent	.92
Responsiveness Child 1	.70
Responsiveness Child 2	.64
Non-compliance Child 1	.80
Non-compliance Child 2	.64
Independence/Autonomy Child 1	.67
Independence/Autonomy Child 2	.537
Verbalization Child 1	.60
Verbalization Child 2	.83
Verbalization Parent	.82
Parental Comparison Independence/Autonomy	.87
Parental Comparison Verbalization	.86

Note. n = 19

Table **17**: Inter-rater reliability statistics for TRICSY (Dyadic and Triadic level variables).

Measure	Cronbach's Alpha
Dyadic Level	
Dyadic Reciprocity Child 1-Child 2	.59
Dyadic Reciprocity Child 1-Parent	.29[1]
Dyadic Reciprocity Child 2-Parent	.69
Dyadic Conflict Child 1-Child 2	.70
Dyadic Conflict Child 1-Parent	.90
Dyadic Conflict Child 2-Parent	.76
Dyadic Cooperation Child 1-Child 2	.66
Dyadic Cooperation Child 1-Parent	.69
Dyadic Cooperation Child 2-Parent	.74
Triadic Level	
Sibling-Parent Dominance (General)	.91
Sibling-Parent Dominance (Comparison)	.86

Note. n = 19. [1]Due to a coder error, this value is not accurate. When the coder is removed the alpha value for 3 coders becomes .47.

Table **18**: Inter-rater reliability statistics for TRICSY ("Free Play" Variables).

Measure	Cronbach's Alpha
"Free Play" variables	
"Free Play" Sibling Positive Affect	.48
"Free Play" Sibling Negative Affect	.68
"Free Play" Sibling Dominance	.78
"Free Play" Sibling Conflict	.95
"Free Play" Sibling Cooperation	.93

Note. n = 8

Table **19**: Exploratory factor analysis- Rotated component matrix.

Variable	C1 load	C2 load	C3 load	C4 load	C5 load	C6 load	C7 load
Parent Positive Affect	.83			-.33			
Child-Parent Reciprocity	.81						
Child Positive Affect	.66						.26
Child Verbalizations	.64	.49					
Child Non-compliance		.90					
Child Responsiveness		-.81					.32
Child-Parent Conflict		.73	-.37		.29		
Child Negative Affect	-.41	.70			.30		
Parent Negative Affect		.37	-.80				
Child Autonomy			.68			.43	
Parent Verbalizations	.459		-.65			.33	
Child-Child Reciprocity			.57	.37			
“Free Play” Dominance				.92			
Child-Parent Cooperation	.64			.68			
Child-Child Cooperation			.44	.59	.30		
Child-Child Conflict		.42		-.49	.50		
“Free Play” Cooperation	-.33				.85		
“Free Play” Positive Affect					.75		
Conflict vs. Cooperation						.88	
Sibling-Parent Dominance (general)					-.42	.73	
Sibling-Parent Dominance (comparison)			-.44	.44		.53	
“Free Play” Conflict							.91
“Free Play” Negative Affect							.76

Note. Extraction-Principal Component Analysis. Rotation- Varimax with Kaiser Normalization. All values < .25 suppressed.

Table **20**: Total variance explained table.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cumul. %	Total	% of Var.	Cumul. %	Total	% of Var.	Cumul. %
1	4.578	19.903	19.903	4.578	19.903	19.903	3.525	15.328	15.328
2	4.236	18.417	38.321	4.236	18.417	38.321	3.308	14.382	29.710
3	3.078	13.384	51.704	3.078	13.384	51.704	2.592	11.268	40.977
4	2.279	9.907	61.611	2.279	9.907	61.611	2.530	11.001	51.978
5	2.072	9.011	70.622	2.072	9.011	70.622	2.313	10.055	62.033
6	1.290	5.609	76.231	1.290	5.609	76.231	2.239	9.735	71.769
7	1.184	5.150	81.381	1.184	5.150	81.381	2.211	9.613	81.381
8	.832	3.619	85.000						
9	.694	3.018	88.018						
10	.589	2.560	90.578						
11	.484	2.105	92.683						
12	.363	1.577	94.260						
13	.311	1.352	95.612						
14	.242	1.052	96.664						
15	.215	.935	97.598						
16	.185	.805	98.403						
17	.124	.540	98.943						
18	.094	.409	99.351						
19	.064	.277	99.628						
20	.042	.184	99.812						
21	.023	.101	99.913						
22	.016	.070	99.983						
23	.004	.017	100.000						

Table **21**: PARCHISY — TRICSY shared variable correlations.

Measures	Pearson Coefficient	Significance level
Child Positive Affect	.17	.02*
Parent Positive Affect	.21	<.01**
Child Negative Affect	.17	.01*
Parent Negative Affect	.34	<.01**
Child Responsiveness	.16	.03*
Child Non-Compliance	.21	<.01**
Child Indep./Autonomy	.15	.04*
Child Verbalizations	.06	.37
Parent Verbalizations	.22	<.01**
Dyadic Reciprocity	.08	.26
Dyadic Conflict	.20	<.01**
Dyadic Cooperation	.06	.42

Note. n = 203. *p < .05, **p < .01. One-tailed.

Table **22**: PARCHISY correlations among measures.

	1	2	3	4	5	6	7	8	9	10	11
1. CPsAf	--										
2. PPsAf	.57**	--									
3. CNgAf	-.07	-.04	--								
4. PNgAf	-.07	-.29**	.15*	--							
5. CResp	.23**	.26**	-.10	-.14*	--						
6. NCom	-.12	-.04	.26**	.35**	-.26**	--					
7. CIndep	.15*	.26**	.19**	-.16*	.25**	-.04	--				
8. CVerb	.28**	.10	.26**	-.16*	.15*	.00	.34**	--			
9. PVerb	.01	.02	-.09	.07	-.12	.05	-.23**	.08	--		
10. DRecip	.50**	.56**	-.02	-.05	.28**	-.09	.17*	.25**	.09	--	
11. DConf	-.07	-.17*	.37**	.49**	-.15*	.42**	.05	-.14*	.03	-.03	--
12. DCoop	.31**	.35**	-.04	-.02	.28**	-.08	.25**	.27**	.09	.73**	.00

Note. n = 203. *p < .05, **p < .01. CPsAf – Child positive Affect, PPsAf- Parent positive affect, CNgAf-Child negative affect, PNgAf- Parent negative affect, CResp- Child responsiveness, CNComp-Child non-compliance, CIndep- Child independence, CVerb-Child verbalizations, PVerb-Parent verbalizations, DRecip-Dyadic reciprocity, DConf-Dyadic conflict, DCoop- Dyadic cooperation.

Table **23**: TRICSY correlations among measures.

	1	2	3	4	5	6	7	8	9	10	11
1. CPsAf	--										
2. PPsAf	.51**	--									
3. CNgAf	-.32**	-.27**	--								
4. PNgAf	-.19**	-.40**	.42**	--							
5. CResp	.25**	.20**	-.52**	-.31**	--						
6. NCom	-.15*	-.11	.62**	.43**	-.68**	--					
7. CIndep	.18*	-.03	.00	-.08	.10	.07	--				
8. CVerb	.50**	.33**	.02	-.10	.08	.06	.24**	--			
9. PVerb	.38**	.42**	-.10	.11	.04	.09	-.12	.27**	--		
10. DRecip	.40**	.35**	-.32**	-.26**	.22**	-.24**	.21**	.29**	.11	--	
11. DConf	-.31**	-.27**	.55**	.62**	-.41**	.53**	-.01	-.08	.04	-.35**	--
12. DCoop	.47**	.35**	-.33**	-.25**	.29**	-.22**	.20**	.28**	.27**	.63**	-.45**

Note. n = 206. *p < .05, **p < .01. CPsAf – Child positive Affect, PPsAf- Parent positive affect, CNgAf-Child negative affect, PNgAf- Parent negative affect, CResp- Child responsiveness, CNComp-Child non-compliance, CIndep- Child independence, CVerb-Child verbalizations, PVerb-Parent verbalizations, DRecip-Dyadic reciprocity, DConf-Dyadic conflict, DCoop- Dyadic cooperation

Table **24**: Year 1 by Year 2 assessment outcome variable correlations.

Measures	Pearson Coefficient
Parent Externalizing	.65
Parent Internalizing	.72
Teacher Externalizing	.61
Teacher Internalizing	.35
Parent Feelings Positivity	.57
Parent Feelings Negativity	.65
Parent Attitudes Positivity	.71
Parent Attitudes Negativity	.57

Note. All correlations significant at $p < .01$ level.

Table **25**: PARCHISY Variable by Year 1 assessment outcome variable correlations.

	Y1Pext	**Y1Pint**	**Y1Text**	**Y1Tint**	**Y1posA**	**Y1negA**	**Y1posB**	**Y1negB**
CPsAf	-.12	.03	.09	-.05	.07	-.03	.06	-.16*
PPsAf	.00	.06	-.04	-.10	.08	.00	.02	-.13
CNgAf	.09	.06	.07	.07	.13	.02	.10	.01
PNgAf	.01	-.15*	.30**	-.09	-.03	.01	-.03	.04
CResp	-.04	.01	-.04	.03	-.08	-.12	-.03	-.04
CNComp	.13	.12	.27**	.00	.10	.15	.02	-.03
CIndep	.10	.13	.00	.11	.01	.05	.07	.14
CVerb	.08	-.01	.07	.01	.11	.03	.15	-.01
PVerb	.12	-.03	.01	.04	-.06	.13	-.12	-.04
DRecip	-.01	-.02	-.05	-.03	.03	-.04	-.01	-.13
DConf	-.03	-.12	.06	-.09	-.13	. 02	-.05	.03
DCoop	.01	-.02	-.08	.02	.01	-.04	.09	-.03

Note. *p < .05, **p < .01. **CPsAf**- Child positive Affect, **PPsAf**- Parent positive affect, **CNgAf**-Child negative affect, **PNgAf**- Parent negative affect, **CResp**- Child responsiveness, **CNComp**-Child non-compliance, **CIndep**- Child independence, **CVerb**-Child verbalizations, **PVerb**-Parent verbalizations, **DRecip**-Dyadic reciprocity, **DConf**-Dyadic conflict, **DCoop**- Dyadic cooperation, **Y1Pext**-Parent-rated externalizing, **Y1Pint**-Parent-rated internalizing, **Y1Text**-Teacher-rated externalizing, **Y1Tint**-Teacher-rated internalizing, **Y1posA**- parent positive feelings, **Y1negA**- Parent negative feelings, **Y1posB**-Parent positive attitudes, **Y1negB**- Parent negative attitudes.

Table **26**: PARCHISY variable by WRRP Year 2 assessment outcome variable correlations.

	Y2Pext	**Y2Pint**	**Y2Text**	**Y2Tint**	**Y2posA**	**Y2negA**	**Y2posB**	**Y2negB**
CPsAf	-.02	.01	-.02	.15	-.04	-.03	.01	-.02
PPsAf	.07	.08	-.07	.07	.00	-.02	-.06	.04
CNgAf	.00	.09	.28**	.12	.06	.02	.06	-.06
PNgAf	-.02	-.18*	.27**	.02	.04	.10	.02	-.03
CResp	-.03	-.05	-.07	-.07	.04	-.12	-.09	.00
CNComp	.07	-.08	.18*	.17*	-.02	.07	.00	.01
CIndep	.06	.00	-.08	-.03	-.01	-.06	.07	-.03
CVerb	-.13	-.11	.13	.05	.00	-.08	.11	-.10
PVerb	.03	-.02	.04	.05	.01	.09	-.12	-.08
DRecip	.06	.02	-.11	.10	-.02	.02	-.08	-.01
DConf	-.09	-.11	.14	.14	.09	-.02	.11	-.10
DCoop	.02	.02	-.01	.14	.01	.00	.01	-.09

Note. *p < .05, **p < .01. **CPsAf**- Child positive Affect, **PPsAf**- Parent positive affect, **CNgAf**-Child negative affect, **PNgAf**- Parent negative affect, **CResp**- Child responsiveness, **CNComp**-Child non-compliance, **CIndep**- Child independence, **CVerb**-Child verbalizations, **PVerb**-Parent verbalizations, **DRecip**-Dyadic reciprocity, **DConf**-Dyadic conflict, **DCoop**- Dyadic cooperation, **Y2Pext**-Parent-rated externalizing, **Y2Pint**-Parent-rated internalizing, **Y2Text**-Teacher-rated externalizing, **Y2Tint**-Teacher-rated internalizing, **Y2posA**- parent positive feelings, **Y2negA**- Parent negative feelings, **Y2posB**-Parent positive attitudes, **Y2negB**- Parent negative attitudes.

Table **27**: TRICSY variable by Year 1 assessment outcome variable correlations.

	Y1Pext	**Y1Pint**	**Y1Text**	**Y1Tint**	**Y1posA**	**Y1negA**	**Y1posB**	**Y1negB**
CPsAf	-.07	-.14	-.03	.16	.02	-.05	-.07	-.14
PPsAf	.00	.02	-.05	-.01	.00	-.01	.14	-.05
CNgAf	.14	.03	.26**	-.01	-.02	.02	.06	.15
PNgAf	-.02	-.06	.15*	.09	-.05	.07	.05	.13
CResp	-.08	-.09	-.12	.03	-.02	-.12	.04	-.12
CNComp	.07	-.03	.26**	-.03	.06	.02	.08	.11
CIndep	.22**	.04	.18*	.17*	-.04	-.01	-.05	.15*
CVerb	-.04	-.06	.18*	.17*	.07	-.02	-.02	.01
PVerb	.04	-.03	.05	.09	.00	.12	-.21**	-.06
DRecip	-.05	.01	-.24**	.07	.05	-.08	-.01	-.03
DConf	.19**	.12	.30**	-.15	-.08	.22**	-.06	.28**
DCoop	-.06	-.07	-.10	.01	.06	-.13	.06	-.16*

Note. *p < .05, **p < .01. **CPsAf**- Child positive Affect, **PPsAf**- Parent positive affect, **CNgAf**-Child negative affect, **PNgAf**- Parent negative affect, **CResp**- Child responsiveness, **CNComp**-Child non-compliance, **CIndep**- Child independence, **CVerb**-Child verbalizations, **PVerb**-Parent verbalizations, **DRecip**-Dyadic reciprocity, **DConf**-Dyadic conflict, **DCoop**- Dyadic cooperation, **Y1Pext**-Parent-rated externalizing, **Y1Pint**-Parent-rated internalizing, **Y1Text**-Teacher-rated externalizing, **Y1Tint**-Teacher-rated internalizing, **Y1posA**- parent positive feelings, **Y1negA**- Parent negative feelings, **Y1posB**-Parent positive attitudes, **Y1negB**- Parent negative attitudes.

Table **28**: TRICSY variable by Year 2 assessment outcome variable correlations.

	Y2Pext	**Y2Pint**	**Y2Text**	**Y2Tint**	**Y2posA**	**Y2negA**	**Y2posB**	**Y2negB**
CPsAf	-.05	-.09	-.06	.11	-.10	-.08	-.03	-.09
PPsAf	-.05	.00	-.07	.14	-.03	-.06	-.07	.00
CNgAf	.03	.05	.19*	-.05	-.03	.05	.04	.04
PNgAf	.05	-.02	.21*	-.09	-.01	.06	.07	.08
CResp	-.06	-.05	-.03	-.06	.03	.01	-.03	-.06
CNComp	-.03	-.06	.18*	-.04	.02	-.02	.10	-.01
CIndep	.10	.03	.02	-.06	.03	.09	-.06	.04
CVerb	-.05	-.06	-.01	.11	.03	-.16*	.05	-.09
PVerb	.00	.03	.05	.00	-.03	.05	-.16*	-.05
DRecip	-.11	.04	-.19*	.14	.12	-.15*	.13	-.15*
DConf	.11	.06	.26**	-.12	-.12	.14	-.09	.20*
DCoop	-.15*	-.06	-.16	.00	.04	-.19	.12	-.10

Note. *p < .05, **p < .01. **CPsAf**- Child positive Affect, **PPsAf**- Parent positive affect, **CNgAf**-Child negative affect, **PNgAf**- Parent negative affect, **CResp**- Child responsiveness, **CNComp**-Child non-compliance, **CIndep**- Child independence, **CVerb**-Child verbalizations, **PVerb**-Parent verbalizations, **DRecip**-Dyadic reciprocity, **DConf**-Dyadic conflict, **DCoop**- Dyadic cooperation, **Y2Pext**-Parent-rated externalizing, **Y2Pint**-Parent-rated internalizing, **Y2Text**-Teacher-rated externalizing, **Y2Tint**-Teacher-rated internalizing, **Y2posA**- parent positive feelings, **Y2negA**- Parent negative feelings, **Y2posB**-Parent positive attitudes, **Y2negB**- Parent negative attitudes.

Table **29**: Triadic variable x Year 1 assessment outcome difference variable ANOVA.

Measures	Mean Square	F value	Significance
Parent Externalizing Difference			
Triadic Dominance (Gen)	0.01	0.64	.53
Triadic Dominance (Comp)	0.00	0.08	.92
Parent Internalizing Difference			
Triadic Dominance (Gen)	0.01	0.61	.55
Triadic Dominance (Comp)	0.00	0.03	.97
Teacher Externalizing Difference			
Triadic Dominance (Gen)	0.00	0.01	.99
Triadic Dominance (Comp)	0.05	2.45	.09
Teacher Internalizing Difference			
Triadic Dominance (Gen)	0.01	0.82	.44
Triadic Dominance (Comp)	0.01	0.63	.54
Parent Feelings Positivity Difference			
Triadic Dominance (Gen)	3.43	0.59	.56
Triadic Dominance (Comp)	2.03	0.35	.71
Parent Feelings Negativity Difference			
Triadic Dominance (Gen)	174.20	3.00	.06
Triadic Dominance (Comp)	8.90	0.15	.87
Parent Attitudes Positivity Difference			
Triadic Dominance (Gen)	9.84	2.02	.14
Triadic Dominance (Comp)	4.53	0.92	.40
Parent Attitudes Negativity Difference			
Triadic Dominance (Gen)	10.17	0.95	.39
Triadic Dominance (Comp)	6.20	0.56	.57

Note. *p < .05, **p < .01.

Table **30**: Triadic variable x Year 2 assessment outcome difference variable ANOVA.

Measures	Mean Square	F value	Significance
Parent Externalizing Difference			
Triadic Dominance (Gen)	0.00	0.25	.78
Triadic Dominance (Comp)	0.00	0.20	.82
Parent Internalizing Difference			
Triadic Dominance (Gen)	0.01	0.53	.59
Triadic Dominance (Comp)	0.02	1.12	.33
Teacher Externalizing Difference			
Triadic Dominance (Gen)	0.03	1.49	.23
Triadic Dominance (Comp)	0.04	2.00	.15
Teacher Internalizing Difference			
Triadic Dominance (Gen)	0.01	0.81	.45
Triadic Dominance (Comp)	0.00	0.08	.93
Parent Feelings Positivity Difference			
Triadic Dominance (Gen)	2.03	0.62	.54
Triadic Dominance (Comp)	0.90	0.27	.76
Parent Feelings Negativity Difference			
Triadic Dominance (Gen)	35.93	0.77	.47
Triadic Dominance (Comp)	26.16	0.55	.58
Parent Attitudes Positivity Difference			
Triadic Dominance (Gen)	6.89	1.28	.28
Triadic Dominance (Comp)	1.40	0.26	.77
Parent Attitudes Negativity Difference			
Triadic Dominance (Gen)	1.39	0.15	.86
Triadic Dominance (Comp)	0.13	0.01	.99

Note. *p < .05, **p < .01.

Table **31**: Triad specific variables x TRICSY observational variable difference ANOVA.

Measures	Mean Square	F value	Significance
Child Positive Affect Difference			
Triadic Dominance (Gen)	2.21	2.86	.06
Triadic Dominance (Comp)	1.12	1.42	.25
Parent Positive Affect			
Triadic Dominance (Gen)	4.66	3.55	.03*
Triadic Dominance (Comp)	0.47	0.34	.72
Child Negative Affect Difference			
Triadic Dominance (Gen)	4.12	3.58	.03*
Triadic Dominance (Comp)	0.48	0.40	.68
Parent Negative Affect			
Triadic Dominance (Gen)	14.12	14.20	<.01**
Triadic Dominance (Comp)	0.70	0.56	.57
Child Responsiveness Difference			
Triadic Dominance (Gen)	9.98	7.35	<.01**
Triadic Dominance (Comp)	0.17	0.11	.90
Child Non-Compliance Difference			
Triadic Dominance (Gen)	5.19	3.66	.03*
Triadic Dominance (Comp)	1.16	0.78	.46
Child Indep./Autonomy Difference			
Triadic Dominance (Gen)	4.76	5.28	<.01**
Triadic Dominance (Comp)	4.08	4.43	.01*
Child Verbalizations Difference			
Triadic Dominance (Gen)	6.31	4.15	.02
Triadic Dominance (Comp)	0.72	0.45	.64
Parent Verbalizations			
Triadic Dominance (Gen)	2.57	3.63	.03*
Triadic Dominance (Comp)	2.20	3.10	.05
Dyadic Reciprocity Difference			
Triadic Dominance (Gen)	9.31	7.79	<.01**
Triadic Dominance (Comp)	0.20	0.15	.86
Dyadic Conflict Difference			
Triadic Dominance (Gen)	1.80	1.40	.25
Triadic Dominance (Comp)	1.40	1.08	.34
Dyadic Cooperation Difference			
Triadic Dominance (Gen)	9.42	8.65	<.01**
Triadic Dominance (Comp)	0.80	0.62	.54
Conflict vs. Cooperation			
Triadic Dominance (Gen)	0.01	0.05	.95
Triadic Dominance (Comp)	0.33	1.98	.14

Note. *p < .05, **p < .01.

Table **32**: MLM Model: Prediction of concurrent and future child externalizing from parent-child dyadic and triadic conflict.

Model	-2ll	χ^2_{Change}	df_{Change}	Sig.
Externalizing (Year 1)				
Intercept	-257.8			
Intercept, Dyadic	-257.8	0.0	1	ns
Intercept, Dyadic, Triadic	-263.7	5.9	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-265.4	7.6	3	ns
Externalizing (Year 2)				
Intercept	-215.1			
Intercept, Dyadic	-215.1	0.0	1	ns
Intercept, Dyadic, Triadic	-216.1	1.0	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-216.2	1.1	3	ns

Note. *p < .05, **p < .01.

Table **33**: MLM Model: Prediction of concurrent and future child externalizing from parent-child dyadic and triadic cooperation.

Model	-2ll	χ^2_{Change}	df_{Change}	Sig.
Externalizing (Year 1)				
Intercept	-257.8			
Intercept, Dyadic	-257.9	0.1	1	ns
Intercept, Dyadic, Triadic	-258.5	0.7	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-259.3	1.5	3	ns
Externalizing (Year 2)				
Intercept	-215.1			
Intercept, Dyadic	-215.2	0.1	1	ns
Intercept, Dyadic, Triadic	-216.0	0.9	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-216.0	0.9	3	ns

Note. *p < .05, **p < .01.

Table **34**: MLM Model: Prediction of concurrent and future child externalizing from child dyadic and triadic interaction non-compliance.

Model	-2ll	χ^2_{Change}	df_{Change}	Sig.
Externalizing (Year 1)				
Intercept	-257.8			
Intercept, Dyadic	-261.5	3.7	1	ns
Intercept, Dyadic, Triadic	-262.9	5.1	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-265.2	7.4	3	ns
Externalizing (Year 2)				
Intercept	-215.1			
Intercept, Dyadic	-216.3	1.2	1	ns
Intercept, Dyadic, Triadic	-216.5	1.4	2	ns
Intercept, Dyadic, Triadic, Dyad *Triad	-217.5	2.4	3	ns

Note. *p < .05, **p < .01.

Chapter 4

DISCUSSION

The purpose of the current study was to examine and investigate the reliability and validity of a measure of triadic family interaction. In the study, we proposed a new triadic coding scheme for use with observed parent-child interactions. This scheme was a modification of two previously used systems, the Parent Child Interaction System (PARCHISY; Deater-Deckard, Pylas, Petrill, 1997) and the Observed Sibling Interaction Global Rating System (Smith, 2005). While each of these systems was developed for use with dyadic interactions, elements of each were useful in the creation and assessment of triadic interactions.

Background Statistical Analyses

Examination of the sample demographic and coded measure descriptive statistics provided a full picture of the sample and the utility of the measures collected. For example, the study sample had a large contingent of mother-daughter twin pair triads. However, there were also a fair number of male twin pairs which allowed for the examination of differential mother-daughter and mother-son analyses. Potential sample effects were examined and found not to be important. For example, there was no significant difference in maternal treatment of male twin pairs as compared to female twin pairs. Due to the size of the coded and observed paternal sample (13% of total sample), comparisons and analyses of paternal differential treatment were not conducted.

Analyses revealed no significant mean differences in any interaction variable during the dyadic and triadic interactions (**Tables 1-6**). On average, twins and parents showed more positive than negative affect, children were more responsive than non-compliant, parents led each task more than their children, through the use of consistent verbalization, and there was more cooperation with greater twin-parent reciprocity than there was conflict for both the dyadic and triadic tasks.

The descriptive data analyses of the outcome variables (**Tables 7-15**) were very similar to the results from the observational data analyses. From the Parent Feelings Questionnaire, Parent Attitudes Questionnaire, and the Child Behavior Checklist, there were no significant mean differences on the variables from the Year 1 or Year 2 assessments. Overall, parents had more positive than negative feelings and attitudes toward their twins, parental feelings were consistent across assessment occasions, and the

results remained consistent when the means were analyzed for differences by parent sex, parent-twin pair configuration, and parent sex by twin. The results from the analysis of the parent and teacher rated child externalizing and internalizing scales from the Child Behavior Checklist revealed no mean differences.

Study Goal 1: Development and testing of an observational triadic coding system

Development and examination of the current triadic observational system (TRICSY) was the objective of the first study goal. Overall, the developments and assessment of the TRICSY scheme was neither a complete success nor failure. The components of the scheme were generally adequate for the assessment of the triadic task. However, additional general (child and parent control) and specific variables (child and parent tone, enumeration of tasks, emotional episode length) could have been helpful in adding more analytical and explanatory depth to the data and analyses. Inter-rater reliability was maintained at a consistently high rate throughout the coding process. The high reliability rate was possible because when an issue was discovered, it was immediately addressed so as not to adversely influence or contaminate the collected and analyzed data. Though not all of the hypotheses were supported, the Triadic Interaction Coding System (TRICSY) was able to evaluate adequately and effectively all of the research questions it was designed to examine within the context of the current study.

Inter-rater reliability was assessed using an alpha model (**Tables 16-18**). The use of this analytical method is both sound and correct given the structure of the study data. The database for reliability analyses was configured in such a way that each coder had his

or her own column of data for each variable in the data set with each row constituting a family. When the data were analyzed, each coder was his or her own unique factor in the reliability analysis making it possible to determine each coder's contribution to the overall scale alpha. As we did not want an overly conservative statistic with the categorical variables used in the TRICSY scheme, using alpha instead of Cohen's Kappa was the proper procedure. Cohen's Kappa (Cohen, 1960) scores a difference of one category between coders as non-agreement and, therefore, would render the entire coding as unreliable. It is not necessary for coders to have the exact same value or be in absolute agreement with their codes with an alpha statistic. It is quite possible for coders to be one or, in a rare occasion, two categories divergent from one another and still allow for the scale to be reliable in a logical sense in the TRICSY scheme. The use of the alpha statistic allows for some variation in the coders responses while still maintaining measure integrity.

The component structure from exploratory factor analysis differed slightly from the hypothesized structure. The hypothesized component structure was a five component structure with positive affective, negative affective, positive "Free Play," negative "Free Play," and triadic specific components composing the structure. The hypothesized structure was based upon variable thematic similarities within the component. For the most part, however, the rotated component structure held to the hypothesized thematic constructs. There were individual components with the positive and negative affective aspects, positive aspects of "Free Play," negative aspects of "Free Play," and the triadic variables. The actual component structure had two additional components that the hypothesized structure did not: child autonomy and parent-child cooperation. It was not

initially hypothesized that these components would be separate. However, they are thematically logical. The results from the exploratory factor analyses exposed a number of split loadings for variables on components. Those variables which loaded nearly evenly in two or three components were particularly troublesome to categorize. In most cases, one of the loadings was very close to the loadings of the other variables in the component. It is possible that the failure to obtain the hypothesized structure was due to the particular task chosen for the triadic observation. The domino task may have increased the level of parent-child cooperation and the underlying behaviors that reinforce it and also had an effect on the degree of child autonomy and its underlying structure.

Study Goal 2: Examine the correlation of the shared PARCHISY and TRICSY variables

The correlation analyses (**Tables 21-28**) showed significant relationships unique to each coding scheme as well as associations between the schemes. The variables which did not significantly correlate between the two schemes (child verbalizations, dyadic cooperation, and dyadic reciprocity) could logically be attributed to the presence of a co-twin. For example, the amount of time a child needed or was able to verbalize, cooperate with his or her parent, or be reciprocal with his or her parent could be reduced by the presence of a co-twin as compared to a dyadic interaction.

Aspects of the dyadic interaction correlated in ways that were consistent with the relationships found in the dyadic and family interaction literature (MacDonald & Parke, 1984; Volling & Belsky, 1992; Deater-Deckard, Atzaba-Poria, & Pike, 2004). Child

positive affect was highly significantly correlated with parent positive affect and reciprocity, whereas child negative affect was moderately correlated with dyadic conflict (**Table** 22). Similar associations were found during triadic interaction (**Table** 23).

Correlation between Year 1 and Year 2 outcomes showed stability outcomes (**Tables 24-28**). Further, dyadic and triadic interaction predicted concurrent and future outcomes to similar degrees. There are however more significant correlations observed between the TRICSY variables and the assessed outcome measures than with the PARCHISY. There may be additional unmeasured interaction based factors which contribute to the increased number of significant relationships found between the TRICSY variables and the outcomes which are not present in the dyadic interactions observed and coded.

Examination of the correlations between the shared variables common to both PARCHISY and TRICSY revealed a series of statistically significant yet small related correlations. Though most of the correlations between the variables for the dyadic and triadic tasks were significantly correlated with one another, only parent negative affect (r = .34) was moderate in size (Cohen, 1960; Hinkle, Wiersma, & Jurs, 1988). The remaining variables shared among the two schemes were either significantly correlated with small relationships to one another or were not significantly correlated and negligibly related to one another. These results appear to suggest that there are different yet slightly related processes being examined between the two coding schemes.

Study Hypothesis 1: Cooperation, conflict and reciprocity in the dyadic and triadic videotaped tasks will be moderately correlated

The correlation analyses of the measured dyadic parent-child variables of cooperation, conflict, and reciprocity (**Table 21**) revealed that only dyadic conflict (r = .20, $p < .01$) was significantly correlated between the dyadic tasks and the triadic domino task, but the association was weak. The other assessed dyadic variables, parent-child cooperation and parent-child reciprocity were neither significant nor related between the dyadic and triadic tasks. The hypothesis for the relationship of these variables across the tasks is not supported by the data collected in the current study.

Study Hypothesis 2: The triadic observational variables will provide descriptive power beyond that of the dyadic scheme in those variables shared among both systems

The hypothesis that among the variables shared by both coding schemes that the triadic scheme variables would provide more descriptive power than the dyadic scheme variables is supported. There are more significant relationships with higher coefficients in the triadic scheme (**Table 23**) than in the dyadic scheme (**Table 22**). These results may point to a difference in the descriptive power between the schemes, or it may just be a function of the differences in the tasks and interactions observed between the PARCHISY and TRICSY schemes.

Study Goal 3: Investigate the relationship between concurrent (Year 1 assessment) parent feelings/attitudes and child behavior problems and the dyadic and triadic scheme observational measures

Mean differences in the outcome measures collected for Year 1 and Year 2 were examined by groupings on the triadic dominance measures collected as part of the TRICSY coding (**Tables 29-31**). The general dominance measure assessed whether one twin dominated the triadic task more than the other, or whether both twins dominated the task equally. There was also a comparative dominance measure coded. This measure assessed whether the children, as a unit, dominated the task more than the parent, the parent dominated the task more than the children as a unit, or if there was parity among the children and the parent.

The results from the analyses with the general dominance measure found that none of the dominance variable by outcome relationships was significant overall. The relationships were not significant for the assessments collected in Year 1 or Year 2 of WRRP. The relationship among the Year 1 parent feelings negativity difference was the only parent feelings variable to present a significant group mean difference, even though the overall relationship was not significant. The significant mean difference revealed that the group in which the children dominated the task equally had parents who had significantly less difference in their negative feelings toward their children than did the group in which twin 2 dominated the task more than twin 1. This finding punctuated the findings as no other assessment outcome variables showed any significant mean differences by general triadic dominance category.

The results from the analyses with the comparison triadic dominance measure revealed no significant mean difference for any of the collected Year 1 or Year 2 outcome variables. Unlike the general triadic dominance measure, none of the outcome variable analyses approached a level of significance to merit further analysis or investigation.

The investigation of the relationship between parent feelings/attitudes and child behavioral outcomes with the dyadic and triadic coded observational variables provided mixed results. The two most prevalent results from the PARCHISY analysis revealed that teacher rated child externalizing was moderately correlated, with parent negative affect and child non-compliance. The same correlations in the TRICSY sample found parent negative affect and child non-compliance to have a similar magnitude of relationship. However, dyadic conflict in the TRICSY scheme was correlated with more outcome variables: parent externalizing, teacher externalizing, parent negative feelings, and parent negative attitudes than in the PARCHISY. Additionally, the magnitudes of those relationships are similar to those observed in the strongest correlations from the PARCHISY scheme. There seems to be a different relationship present among the PARCHISY and the concurrent outcome measures than is present between the TRICSY scheme variables and the outcomes.

Study Hypothesis 3: The triadic scheme observational variables will account for additional descriptive ability in parent feelings/attitudes and concurrent and later assessments of child externalizing beyond that accounted for by the dyadic scheme variables

The hypothesis that the triadic scheme variables can provide more predictive power than the dyadic scheme variables on the outcome variables from both assessment occasions appears to have some support from the data. As was the case for the shared scheme variables, there were more significant correlations between the TRICSY variables and the outcomes than were present in the PARCHISY variable samples. The correlations that are common to both systems are relatively similar. Additionally, within each coding scheme the correlations are stable across assessment time points. Though there are more significant correlations among the TRICSY variables and the measured outcomes, it is unclear what the underlying reason for the trend may be. Overall, this hypothesis seems to be supported by the data. However, the specific sources of variance are still not clear.

Study Goal 4: Test the predictive ability of triadic task observations with later (Year 2 assessment) parent rated child externalizing and variables from the PARCHISY and TRICSY schemes

Multilevel Modeling analyses in the form of Hierarchical Linear Modeling (HLM) sought to evaluate whether the TRICSY coding scheme was more effective than the PARCHISY coding scheme at detecting current behavioral outcomes and predicting future outcomes. A series of three analyses was examined using HLM.

The first analysis sought to evaluate the degree to which dyadic parent-child conflict measured during both the dyadic and triadic task was predictive of concurrent and future child externalizing. The results of the analysis revealed that the triadic scheme was not a significantly better predictor of concurrent and future externalizing behavior. However, the predictive ability was not a significant improvement over the ability of the dyadic system to make the same prediction.

The second analysis investigated the ability of dyadic parent-child cooperation measured in both the dyadic and triadic tasks to predict concurrent and future child externalizing. In Year 1 the model with the triadic scheme variable was the only one that improved the model fit, even though the change in model fit was not significantly better than the base intercept model. For Year 2 the model with the triadic variable and the model including the interaction between the scheme variables improved model fit. As was the case previously, none of the model fit changes were significantly better than the base intercept model.

The third analysis examined the child non-compliance measured in both the dyadic and triadic task to predict concurrent and future child externalizing. In the analyses with concurrent externalizing, only the PARCHISY variable model provided an improvement in model fit. The analyses predicting future externalizing behavior exhibited improved model fit for all of the models. However, none of the models was a significant improvement over the base intercept model.

The ability of the TRICSY and PARCHISY variables of parent-child conflict, parent-child cooperation, and child non-compliance to predict later assessed child externalizing was assessed using HLM. Each analysis included a base intercept model

and three models with the PARCHISY variable, TRICSY variable, and an interaction term (PARCHISY x TRICSY) added sequentially. Each of the models was assessed in comparison to the intercept model and the preceding model to analyze model fit in terms of -2 Log Likelihood (-2ll), Chi-square change, and change in degrees of freedom. None of the analyzed models provided a significant improvement over the intercept model.

Study Hypothesis 4: The triadic task will predict additional independent variance in the prediction of future behavioral outcomes beyond that predicted by the dyadic tasks

Examination of the difference between the PARCHISY and TRICSY variables in prediction of future externalizing outcomes as assessed in Year 2 of WRRP from the HLM analyses provides differing results dependent upon the observational variable examined. With the parent-child conflict analysis the TRICSY variable provides the best model fit of all of the tested models, though not significantly better than the dyadic model. In the parent-child cooperation analyses, the interaction term of the PARCHISY-TRICSY variable provides the best model fit, though again, it is not a significantly better fit than the base model. Finally, in the child non-compliance analyses, both the dyadic and interaction terms provide a better model fit than does the TRICSY variable model. These results are inconsistent with respect to whether the hypothesis is supported or not. Based upon the results the triadic task is not consistently better than the dyadic task at predicting future child externalizing behavior.

Chapter 5

CONCLUSIONS

Limitations

There were some limitations, both procedural and methodological, in the current study. These limitations reduced the effectiveness of the TRICSY scheme to efficiently assess and address all of the stated goals and hypotheses. The inefficiencies were not due to a single limitation. Each stated limitation independently contributed to some methodological or procedural weakness. Some of the limitations were beyond the control of the research team; others were discovered during the course of data collection.

The most significant methodological limitations present in the current study included the limited paternal sample, the absence of a dyadic child task, aspects of the interaction that were not assessed, and the separation of the dyadic and triadic tasks.

The absence of a significant paternal involvement sample limited not only the ability to make meaningful comparisons between mothers and fathers but also to generalize the findings of the father-twin pair triads who participated in the study. It is possible that with a more substantial paternal sample more meaningful evaluation of potential differences in maternal and paternal interactions could be analyzed. As previously mentioned, there is scant literature on paternal involvement.

Another limitation which may have reduced the effectiveness of the triadic coding scheme was the absence of a dyadic interaction involving only the twins. This aspect

missing from the larger WRRP protocol leaves out what may be a crucial aspect of the familial interaction environment. The TRICSY scheme takes into account all of the relationships present in the triad and has a comparison in the PARCHISY; however, there is nothing with which to compare the twin dyad variables. Perhaps future studies can incorporate this aspect and make meaningful comparisons.

Examination of aspects of the interaction not included in the TRICSY system may have been able to add more depth to the analyses. For example, inclusion of variables such as positive and negative control, an enumeration of the number of times a particular coded behavior occurred, and examining parental and child tone were all discussed during the coding process as potential considerations for future examination.

The final methodological limitation which may have impacted the current study was the fact that the dyadic and triadic tasks were separate. This limitation has less to do with the tasks chosen and more to do with the fact that the co-twin was brought into the interaction only after the first set of dyadic tasks was completed. The inclusion of the co-twin at that point might bias the relationship dynamics measured because a sense of rapport may have been established between the first twin and the parent. This particular situation could have an impact on the coded dynamics of the triadic task.

The most significant procedural limitations encountered in the current study were related to training and reliability. The procedural limitation from training was closely related to the limitation attributed to reliability. Though all coders were trained prior to the start of coding, coder differences in observation were still present. As was mentioned in the results section, the reliability statistic for dyadic reciprocity was .292 for all four (4) coders and .472 with three (3) coders. This is an example of how differences in

interpretation at the coding level can impact the results. Due to findings such as these, reliability checking and discussion was conducted after each set of five reliability videotapes. The reciprocity variables were the only variables which suffered appreciably from interpretational bias in reliability coding.

Research Implications

Though the current triadic coding scheme may not be the benchmark for analyzing triadic familial processes, it is not without merit. The TRICSY scheme has a number of aspects which can be considered adequate in the evaluation of triadic and higher order familial interactions. TRICSY has in its basic construction the means to analyze and evaluate all members of a triadic interaction at the individual, dyadic, and triadic levels. Though unable to produce the optimum coding system for triadic interactions, lessons learned in this study can be carried forward to other studies and applied in future research. The current study exhibited that dyadic measures and analysis of the WRRP data has the requisite ability, based on contemporary literature and methodology, to evaluate the relationships present in the data. Though the correlation analyses seemed to show some differences between the PARCHISY and TRICSY schemes in descriptive ability, these results did not hold up under more rigorous examination. There was no indication from the MLM analyses that the TRICSY coding scheme added any more explanatory power in the prediction of outcomes as compared to the PARCHISY.

The implications of creating a truly complete coding scheme in which all levels of data for a triadic interaction are contained can only expand the explanatory power of the system. The more complete and thorough a coding scheme is, the better it may be able to investigate the data and uncover relationships not innately apparent. Development of such a scheme may be the first step in establishing a foundation on which triadic and higher order interaction research can build and expand. The current study is not the first to attempt such a feat, and it certainly will not be the last.

The literature on dyadic, triadic, and group interaction and familial relationship processes seem to support the idea of an inclusive, multi-faceted instrument for the evaluation of these processes. Benenson, Apostoleris, & Parnass (1997) believe that group interactions should be coded from dyadic and higher levels simultaneously. They explain that through the use of a single task assessed on multiple interactional levels, more explanatory power can be gained. As stated by Ishikawa and Hay (2006), it is important to distinguish the level of participation and engagement in the interaction task as well. Elements such as gaze and control can have an impact upon the measurement and understanding of the interactional setting. “Minimal participation” or a member of the triad just watching the other members interact can be coded in a number of ways. An individual who is not engaging actively in the task may be coded as disengaged or off-task, but such ratings may be inaccurate. For example, if a child were participating in our domino task and had already used all of his or her dominos, his or her only participation in the task would have to be as a passive observer, given the task directions. This would constitute minimal participation and, therefore, would warrant further examination. It may, in fact, be the case that the child is offering more guidance in

the form of verbal direction or leading to the other members. To this end, additional understanding of the context of actions within the interaction is just as important as the coding of the actions. Understanding and taking into account the complexity of triadic and group interactions beyond that of dyads is essential to any study of social interaction, whether familial or peer focused.

Future Directions

Potential future studies examining group interactions within the context of families with two children may wish to consider including all members of the family. Studies in which all caregivers participate in the measured group interactions may be able to elucidate some of the more intricate and unique aspects of the study of family interactions. Having all members of a family participate and be coded at the individual, dyadic, triadic, and tetradic levels would add a level of complexity to the coding scheme. The data collected from that coding would also add an invaluable level of reliability and completeness to the analyses conducted. Early work such as that presented in Kreppner, Paulsen and Schultze (1982) provided a working foundation for higher order infant and familial interaction analyses to grow. The power to examine and compare the relationships and attitudes of individuals, dyads, etc. would provide an unmatched level of exploratory and descriptive rigor. Though not an easy undertaking, studies such as these could be a foundation on which complex group interaction models could be formed, refined, and examined.

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Appendix A
Description of Measures in PARCHISY Coding Scheme

Measure	Description
Mother Codes	
Positive Content (control)	Use of praise, explanation, and open-ended questions
Negative Content (control)	Use of physical control of dials or child's hand/arm/body, use of criticism; (physical control of dials or child's body must be with intention, not accidental or momentary. Touching a dial, for instance, is not necessarily an instance of negative control - touching the dial and turning it implies intention, and would be coded as an instance of negative control, even if it was very quickly done)
Positive Affect	Smiling, laughing
Negative Affect	Rejection: frowning, cold/harsh voice
Responsiveness to Child	Responsiveness to child's questions, comments, behaviors
Parent On-task	Initiative/persistence: persistence is with respect to the task that we have given them - doing some other drawing does not qualify as completing the task
Parent Verbalizations	Verbalizations of any kind by the parent
Child Codes	
Positive Affect	Smiling, laughing
Negative Affect	Rejection: frowning, cold/harsh voice

Responsiveness to Mother	Responsiveness to mother's questions, comments, behaviors: responses can be either verbal or behavioral
Child On-task	Initiative/persistence: persistence is with respect to the task that we have given them - doing some other drawing does not qualify as completing the task
Non-compliance	Purposeful ignoring the mother
Autonomy/Independence	Child leads and controls task; does not include off-task behaviors
Activity/Energy	Includes all minor body movements (moving arms, pointing to stimuli or places on screen) and major body movements (jumping up and down, getting up and sitting down) not including fine motor manipulation of dials.
Verbalizations	Verbalizations of any kind by the child
Dyadic Codes	
Reciprocity	Shared positive affect, eye contact, a "turn taking" (i.e., conversation-like) quality of interaction
Conflict	Minor or major disagreement - mutual or shared negative affect; arguing, tussling over toy, etc.
Cooperation	Defined as explicit agreement and discussion, about how to proceed with and complete task (e.g., "Shall we do this next?" and child says "Yes")

Appendix B
Description of Measures in Observed Sibling Interaction Global Rating System

Measure	Description
Single Sibling Codes	
Positive Affect	Explicit episodes of smiling and laughing during the task
Negative Affect	Explicit anger and sadness (such as frowning, harsh/cold tones, pouting, crying or name-calling)
Leadership/Control	How much the sibling took control of the task
Positive Control	Use of praise or explanation and asking how to proceed with the task, giving positive feedback
Negative Control	Physically taking control of the task materials, with the intention to control the task
Accommodation	Degree to which one sibling voluntarily made allowances for the other child, to make the task "easier" for the other sibling
Task Engagement	Degree to which a sibling was involved in the task
Engagement with Respect to Sibling Interaction	Degree of engagement of both siblings
Initiative in Interaction	Degree to which the child was the initiator during the interaction
Responsiveness	Verbal or behavioral responses to any verbal or behavioral interaction initiation

Non-compliance	Degree to which a child purposefully ignored, refused, or did something contrary to what the other child suggested or asked
Competitiveness	Degree to which a child explicitly competed with his or her sibling during the task
Cheating	Rating of the degree to which a child explicitly cheated during the task
Activity Level/Energy	Degree of movement and energy during the task
Verbalizations	Amount of talking, singing or verbal sounds uttered during the task
Affection/Love	Coders' impressions of love/affection during the task
Hostility/Hate	Coders' impressions of hostility/hate during the task
Dyadic Codes	
Orientation/Proximity	Relative shoulder position and physical contact and head/hand position
Conflict	Any minor or major disagreement that involved mutual negative affect
Who Initiated	Which sibling initiated conflict
Cooperative vs. Parallel Play (Puzzle only)	Degree to which siblings worked together to complete task
Verbal Cooperation	Explicit verbal agreement and discussion
Reciprocity	Cohesiveness of interaction including shared positive affect, eye contact, and turn-taking/ conversation-like
Anti-social Behavior Checklist	Frequency of aggressive and anti-social behaviors during the interaction

Appendix C

Description of Measures in TRICSY Coding Scheme

Measure	Description
General Information	
Parent-Child Sex Configuration	Description of the sex of the participating parent and twins
Orientation of the Interaction	Description of the orientation of the interaction as seen on the TV screen
Individual-Specific Coded Items (Child 1, Child 2, Parent)	
Positive Affect	Explicit observed smiling, laughing during the task
Negative Affect	Explicit observed negativity, anger, sadness, rejection: frowning, cold/harsh voice tones
Verbalizations	Talking, singing, verbal sounds uttered during the task
Individual-Specific Coded Items (Child 1, Child 2)	
Responsiveness to Parent	Responsiveness to parent's questions, comments, behaviors (verbal or behavioral interaction by the parent during the task)
Non-compliance	Degree to which the child purposefully ignored, refused, or acted to the contrary of what was asked by the parent
Autonomy/Independence	Degree to which the child takes a direct teaching or directing role in the task

Comparison of Individual-specific Coding Items (Children)	
Positive Affect	Comparison of sibling differences in positive affect
Negative Affect	Comparison of sibling differences in negative affect
Responsiveness	Comparison of sibling differences in responsiveness
Non-compliance	Comparison of sibling differences in non-compliance
Autonomy/Independence	Comparison of sibling differences in autonomy/independence
Verbalizations	Comparison of sibling differences in verbalizations
Comparison of Individual-specific Coding Items (Parent-Ch1 vs. Parent-Ch2)	
Autonomy/Independence	Determination of whether the parent led the task compared to the children
Verbalization	Determination of whether the parent verbalized more compared to the children
Dyad-specific Coding (Ch1-Ch2, Ch1-Parent, Ch2-Parent)	
Reciprocity	Shared positive affect, eye contact, evidence of a "turn-taking" quality of the interaction
Conflict	Minor or major disagreement; mutual or shared negative affect; arguing or tussling over the dominos
Cooperation	Explicit agreement and discussion about how to proceed with and complete the task

Triadic-specific Coding Items
(Ch1-Ch2-Parent)

Sibling vs. Parent Dominance (General)	Defined as domination of the task by one child, defined taking resources or opportunity unequally away from the other child; or if they are the main focus of the interaction
Sibling vs. Parent Dominance (Comparison)	Determination of whether the parent or children together dominated and controlled the task
Conflict vs. Cooperation (Overall)	Balance of conflict and cooperation in the interaction

Appendix D
Summary of Coding Variable Sources

Measure	PARCHISY	OSIGRS	TRICSY
Parent-Child Sex Configuration			X
Orientation of Interaction			X
Positive Affect	X	X	X
Negative Affect	X	X	X
Verbalizations	X	X	X
Responsiveness to Parent	X	X	X
Non-Compliance	X	X	X
Autonomy/Independence	X	X	X
Dyadic Reciprocity	X	X	X
Dyadic Cooperation	X	X	X
Dyadic Conflict	X	X	X
Sib vs. Parent Dominance (gen)			X
Sib. vs. Parent Dominance (comp)			X
Conflict vs. Cooperation			X

Note. OSIGRS - Observed Sibling Interaction Global Rating System. X – present in the coding scheme.

Appendix E

Coding Rubric

Coder name: _____

View

a. First Child
b. Second Child

FID #: _____
SID 1: _____ **Name:** _____
SID 2: _____ **Name:** _____

Child 1 Identifier: _____
Child 2 Identifier: _____

1) **Project**
   a. Twin—MZ Twins
   b. Twin—DZ Twins

2) **Configuration of parents and children:**
   a. Mother and 2 sons
   b. Father and 2 sons
   c. Mother and 2 daughters
   d. Father and 2 daughters

3) **Orientation of the interaction:**
   a. Ch1…Par…Ch2

   b. Ch1 Ch2
      Par

   c. Par
      Ch1 Ch2

   d. Ch1
      Par
      Ch2

   e. Ch1
      Par
      Ch2

   f. Other (Please Draw)

Individual General Coding

4) **Positive affect (warmth): Explicit observed smiling, laughing during task**:

Child 1—

(1) No positive affect displayed
(2) One or two instances of positive affect
(3) A few/several instances of positive affect
(4) Moderate amounts of positive affect - smiling, laughing for about half of interaction
(5) Positive affect for more than half of interaction
(6) Substantial amounts of positive affect; only one or two instances of non-positive affect
(7) Constant positive affect - smiling and laughing throughout task

Child 2—

(1) No positive affect displayed
(2) One or two instances of positive affect
(3) A few/several instances of positive affect
(4) Moderate amounts of positive affect - smiling, laughing for about half of interaction
(5) Positive affect for more than half of interaction
(6) Substantial amounts of positive affect; only one or two instances of non-positive affect
(7) Constant positive affect - smiling and laughing throughout task

Parent—

(1) No positive affect displayed
(2) One or two instances of positive affect
(3) A few/several instances of positive affect
(4) Moderate amounts of positive affect - smiling, laughing for about half of interaction
(5) Positive affect for more than half of interaction
(6) Substantial amounts of positive affect; only one or two instances of non-positive affect
(7) Constant positive affect - smiling and laughing throughout task

5) **<u>Negative affect: Explicit observed negativity anger, sadness, rejection: frowning, cold/harsh voice tones</u>**:

Child 1—

(1) No negative affect displayed
(2) One or two instances of negative affect
(3) A few/several instances of negative affect
(4) Moderate amounts of negative affect - frowning, stern looking, and harsh/cold voice for about half of interaction
(5) Negative affect for more than half of interaction
(6) Substantial amounts of negative affect; only one or two instances of non-negative affect
(7) Constant negative affect - always scowling/frowning, voice always in harsh tones

Child 2—

(1) No negative affect displayed
(2) One or two instances of negative affect
(3) A few/several instances of negative affect
(4) Moderate amounts of negative affect - frowning, stern looking, and harsh/cold voice for about half of interaction
(5) Negative affect for more than half of interaction
(6) Substantial amounts of negative affect; only one or two instances of non-negative affect
(7) Constant negative affect - always scowling/frowning, voice always in harsh tones

Parent—

(1) No negative affect displayed
(2) One or two instances of negative affect
(3) A few/several instances of negative affect
(4) Moderate amounts of negative affect - frowning, stern looking, and harsh/cold voice for about half of interaction
(5) Negative affect for more than half of interaction
(6) Substantial amounts of negative affect; only one or two instances of non-negative affect
(7) Constant negative affect - always scowling/frowning, voice always in harsh tones

6) **Responsiveness to parent's questions, comments, behaviors (verbal or behavioral response to any verbal or behavioral interaction by parent during task)**

Child 1—

(1) Never responds; ignores parent's comments, questions, and behaviors
(2) One or two instances of responding to parent
(3) A few/several instances of responding to parent
(4) Moderate amounts of responsiveness - responds to about half of parent's comments, questions, and behaviors, although some responses may be delayed
(5) Responds more than half the time, with only a few delays in responses
(6) Responds to most of parent's comments, questions, and behaviors, with no delay; only one or two instances of non-responsiveness.
(7) Always responds immediately to parent; expands on some comments made by parent

Child 2—

(1) Never responds; ignores parent's comments, questions, and behaviors
(2) One or two instances of responding to parent
(3) A few/several instances of responding to parent
(4) Moderate amounts of responsiveness - responds to about half of parent's comments, questions, and behaviors, although some responses may be delayed
(5) Responds more than half the time, with only a few delays in responses
(6) Responds to most of parent's comments, questions, and behaviors, with no delay; only one or two instances of non-responsiveness.
(7) Always responds immediately to parent; expands on some comments made by parent

7) **Noncompliance (degree to which the child purposefully ignored refused or acted to the contrary of what was asked by parent)**

Child 1—

(1) Always does what is asked by parent during task
(2) One or two instances of noncompliance
(3) A few/several instances of noncompliance
(4) Moderate amounts of noncompliance - during about half of the interaction
(5) Noncompliant for more than half of the interaction, with a few/several instances of compliance
(6) Substantial amounts of noncompliance; only one or two instances of compliance

(7) Noncompliant throughout task; always refuses or does something contrary to that which is asked of him/her; no instances of compliance

Child 2—

(1) Always does what is asked by parent during task
(2) One or two instances of noncompliance
(3) A few/several instances of noncompliance
(4) Moderate amounts of noncompliance - during about half of the interaction
(5) Noncompliant for more than half of the interaction, with a few/several instances of compliance
(6) Substantial amounts of noncompliance; only one or two instances of compliance
(7) Noncompliant throughout task; always refuses or does something contrary to that which is asked of him/her; no instances of compliance

8) **Autonomy/independence: child leads and controls task (degree to which the child takes a direct teaching or directing role in the task).**

Child 1—

(1) No evidence of autonomy/independence; parent leads throughout task
(2) One or two instances of child's autonomy
(3) A few/several instances of child's autonomy
(4) Moderate amounts of autonomy; controls task about half of the time
(5) Controls task for more than half of the time
(6) Substantial autonomy - one or two instances of following parent's lead
(7) Completely independent - controls entire task from beginning to end

Child 2—

(1) No evidence of autonomy/independence; parent leads throughout task
(2) One or two instances of child's autonomy
(3) A few/several instances of child's autonomy
(4) Moderate amounts of autonomy; controls task about half of the time
(5) Controls task for more than half of the time
(6) Substantial autonomy - one or two instances of following parent's lead
(7) Completely independent - controls entire task from beginning to end

9) **<u>Verbalizations (talking, singing, verbal sounds uttered during task)</u>**

Child 1—

(1) None
(2) One or two utterances
(3) A few/several utterances
(4) Multiple utterances; moderate amounts of speaking; talks during about half of the interaction
(5) Talks during more than half, but not through entire, interaction
(6) Substantial amounts of speaking; only one or two moments when not talking
(7) Speaks throughout the interaction; No clear moments of silence

Child 2—

(1) None
(2) One or two utterances
(3) A few/several utterances
(4) Multiple utterances; moderate amounts of speaking; talks during about half of the interaction
(5) Talks during more than half, but not through entire, interaction
(6) Substantial amounts of speaking; only one or two moments when not talking
(7) Speaks throughout the interaction; no clear moments of silence

Parent—

(1) None
(2) One or two utterances
(3) A few/several utterances
(4) Multiple utterances; moderate amounts of speaking; talks during about half of the interaction
(5) Talks during more than half, but not through entire, interaction
(6) Substantial amounts of speaking; only one or two moments when not talking
(7) Speaks throughout the interaction (excluding when child is speaking); no clear moments of silence

Comparison Coding of Individuals (Children)

10) Positive Affect 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

11) Negative Affect 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

12) Responsiveness 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

13) Non-compliance 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

14) Autonomy 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

15) Verbalizations 2 (Comparison)
    a. Child 1 shows significantly more than Child 2 (> -2)
    b. Child 2 shows significantly more than Child 1 (> +2)
    c. There are slight differences between siblings (= +/-2)
    d. There is no difference between siblings (+/- 0,1)

Comparison Coding of Individuals (Parent)

16) Autonomy 3 (Comparison)
    a. Parent shows more leading than both children
    b. Parent shows more leading than Child 1 but not Child 2
    c. Parent shows more leading than Child 2 but not Child 1
    d. Both children show more leading than Parent

17) Verbalizations 3 (Comparison)
    a. Parent verbalizes more with Child 1 than Child 2
    b. Parent verbalizes more with Child 2 than Child 1
    c. Parent verbalizes roughly equally with both children
    d. Parent does not verbalize with children

Dyad Coding

18) **Reciprocity: Shared positive affect, eye contact, a "turn taking" (i.e., conversation-like) quality of interaction**

Child 1—Child 2

(1) No evidence of reciprocity
(2) One or two instances of reciprocity - either shared affect or eye contact
(3) A few/several instances of reciprocity (either shared affect or eye contact)
(4) Moderate levels of reciprocity; evidence of both shared affect and eye contact; some evidence of "conversation-like" interaction
(5) Clear evidence of reciprocity; one or two episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns" between parent and child
(6) Substantial reciprocity involving numerous episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns;" only one or two instances of non-reciprocity
(7) Highly integrated and reciprocal - constant shared positive affect and eye contact that never loses "turn taking" quality

Child 1—Parent

(1) No evidence of reciprocity
(2) One or two instances of reciprocity - either shared affect or eye contact
(3) A few/several instances of reciprocity (either shared affect or eye contact)
(4) Moderate levels of reciprocity; evidence of both shared affect and eye contact; some evidence of "conversation-like" interaction
(5) Clear evidence of reciprocity; one or two episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns" between parent and child;
(6) Substantial reciprocity involving numerous episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns;" only one or two instances of non-reciprocity
(7) Highly integrated and reciprocal - constant shared positive affect and eye contact that never loses "turn taking" quality

Child 2—Parent

(1) No evidence of reciprocity
(2) One or two instances of reciprocity - either shared affect or eye contact
(3) A few/several instances of reciprocity (either shared affect or eye contact)
(4) Moderate levels of reciprocity; evidence of both shared affect and eye contact; some evidence of "conversation-like" interaction
(5) Clear evidence of reciprocity; one or two episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns" between parent and child;
(6) Substantial reciprocity involving numerous episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns;" only one or two instances of non-reciprocity
(7) Highly integrated and reciprocal - constant shared positive affect and eye contact that never loses "turn taking" quality

19) <u>Conflict: Minor or major disagreement - mutual or shared negative affect; arguing, tussling over toy, etc.</u>

Child 1–Child 2

(1) No evidence of conflict during task
(2) One or two instances of conflict
(3) A few/several instances of conflict
(4) Moderate amounts of conflict - about half of interaction is conflict-related
(5) Conflicted interaction throughout, with a few/several instances of no conflict
(6) Substantial conflict throughout, with only one or two instances of no conflict
(7) Highly conflicted interaction for entire task

Child 1–Parent

(1) No evidence of conflict during task
(2) One or two instances of conflict
(3) A few/several instances of conflict
(4) Moderate amounts of conflict - about half of interaction is conflict-related
(5) Conflicted interaction throughout, with a few/several instances of no conflict
(6) Substantial conflict throughout, with only one or two instances of no conflict
(7) Highly conflicted interaction for entire task

Child 2–Parent

(1) No evidence of conflict during task
(2) One or two instances of conflict
(3) A few/several instances of conflict
(4) Moderate amounts of conflict - about half of interaction is conflict-related
(5) Conflicted interaction throughout, with a few/several instances of no conflict
(6) Substantial conflict throughout, with only one or two instances of no conflict
(7) Highly conflicted interaction for entire task

20) **Cooperation: Explicit agreement and discussion about how to proceed with and complete task (as opposed to working separately)**

Child 1–Child 2

(1) No evidence of cooperation during task
(2) One or two instances of cooperation
(3) A few/several instances of cooperation
(4) Moderate amounts of cooperation - appears during about half of interaction
(5) Cooperative interaction throughout, with few/several instances of lack of explicit cooperation
(6) Substantial cooperation throughout, with only one or two instances of lack of explicit cooperation
(7) Highly cooperative interaction for entire task

Child 1–Parent

(1) No evidence of cooperation during task
(2) One or two instances of cooperation
(3) A few/several instances of cooperation
(4) Moderate amounts of cooperation - appears during about half of interaction
(5) Cooperative interaction throughout, with few/several instances of lack of explicit cooperation
(6) Substantial cooperation throughout, with only one or two instances of lack of explicit cooperation
(7) Highly cooperative interaction for entire task

Child 2–Parent

(1) No evidence of cooperation during task
(2) One or two instances of cooperation
(3) A few/several instances of cooperation
(4) Moderate amounts of cooperation - appears during about half of interaction
(5) Cooperative interaction throughout, with few/several instances of lack of explicit cooperation
(6) Substantial cooperation throughout, with only one or two instances of lack of explicit cooperation
(7) Highly cooperative interaction for entire task

Triadic Coding Items

21) **Sibling/Parent dominance** (General) **: A child dominates if they take resources or opportunity unequally away from the other child; if they are the main focus of the interaction (i.e., parent is more involved with one child than other to the detriment of the interaction as a whole)**
   a. Child 1 dominated the task more than Child 2 and parent
   b. Child 2 dominated the task more than Child 1 and parent
   c. Child 1 dominated the task more than Child 2 but not parent
   d. Child 2 dominated the task more than Child 1 but not parent
   e. Child 1 dominated task more than parent but not Child 2
   f. Child 2 dominated task more than parent but not Child 1
   g. Both children dominated the task equally compared to one another

22) **Sibling/Parent dominance** (Comparison)
   a. Children dominated the task more than the parent
   b. Parent dominated the task more than the children
   c. There was equal domination of the task

23) **Conflict versus Cooperation rating** (Overall)
   a. There was more conflict than cooperation
   b. There was more cooperation than conflict
   c. There were equal parts conflict and cooperation

"Free Play" Coding Items

24) Is there a period of at least 1 minute at the end of interaction (after they have finished the assigned domino task) in which the family engages in "Free Play?"

a. Yes (**Continue thru 29**) and **Note Start and Stop times**
b. No (**End coding**)

25) How is the overall level of positive affect between the siblings compared to the level during the domino task?

a. There is greater affect during the "Free Play" than during the Domino task
b. There is less affect during the "Free Play" than during the Domino task
c. There is no difference in affect between "Free Play" and the Domino task

26) How is the overall level of negative affect between the siblings as compared to the level during the domino task?

a. There is greater affect during the "Free Play" than during the Domino task
b. There is less affect during the "Free Play" than during the Domino task
c. There is no difference in affect between "Free Play" and the Domino task

27) How is the overall level of dominance between the siblings as compared to the level during the domino task?

a. There is greater dominance during "Free Play" than during Domino task
b. There is less dominance during "Free Play" than during the Domino task
c. There is no difference in dominance among "Free Play" and Domino task

28) How is the overall level of conflict between the siblings as compared to the level during the domino task?

a. There is greater conflict during "Free Play" than during Domino task
b. There is less conflict during "Free Play" than during the Domino task
c. There is no difference in conflict among "Free Play" and Domino task

29) How is the overall level of cooperation between the siblings compared to the level during the domino task?

a. There is greater cooperation during "Free Play" than during Domino task
b. There is less cooperation during "Free Play" than during the Domino task
c. There is no difference in cooperation among "Free Play" and Domino task

VITA

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Selected Professional Experiences at The Pennsylvania State University:

2003-Present	**Graduate Research Assistant;** Center for Developmental and Health Genetics
2007	**Course Instructor;** BBH 146: Health and Human Sexuality; Department of Biobehavioral Health; Summer Session #1
2006	**Graduate Teaching Assistant;** BBH 143: Drugs, Behavior and Health; Department of Biobehavioral Health; Fall Semester
2006	**Course Instructor;** BBH 146: Health and Human Sexuality; Department of Biobehavioral Health; Summer Sessions 1 & 2
2001-2003	**Project Coordinator;** Northeast-Northwest Collaborative Adoption Project
1999-2001	**Research Assistant;** Biobehavioral Health Studies Laboratory

Honors and Special Awards:

May 2007:	Penn State Graduate School Teaching Certificate for Graduate Students
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June 1995:	Howard Hughes Undergraduate Research Fellow

Additional Relevant Training:

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