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Trajectories of Children's Social Interactions with their Infant Sibling in the First Year: A Multi-Dimensional Approach

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Abstract

Individual differences in longitudinal trajectories of children's social behaviors toward their infant sibling were examined simultaneously across multiple social dimensions: Positive engagement (moving toward), Antagonism (moving against), and Avoidance (moving away). Three distinct social patterns were identified: (C1) *Positively-Engaged (n*=107, 50%); (C2) *Escalating-Antagonism (n*=90, 42%); and (C3) *Early-Onset Antagonism (n*=16, 8%). Children in the *positively-engaged* class had high levels of positive engagement with their infant siblings, coupled with low levels of antagonism and avoidance. The *escalating-antagonism* class was positively engaged in sibling interaction with a steep escalation in antagonistic behavior and avoidance from 4 to 12 months. Children in the *early-onset antagonism* class displayed the highest level of antagonistic behavior starting as early as 4 months, and became increasingly avoidant over time. A path model, guided by a *process* × *person* × *context* × *time* model, revealed that low parental self-efficacy heightened by parenting stress and children's dysregulated temperament was directly related to the escalating-antagonism pattern. Punitive parenting in response to children's antagonistic behavior increased the likelihood of being in the early-onset antagonism class. Together, the results highlighted heterogeneity in the earliest emergence of sibling interaction patterns and the interplay of child and parent factors in predicting distinct sibling interaction trajectory patterns.

Keywords

Sibling Interaction; Trajectory Patterns; Birth of a Sibling; Temperament; Parenting

The birth of a second child is a normative life event for most children, which brings about significant changes in the family environment (Dunn, 1983; Volling, 2012). Most firstborn children experience the transition to siblinghood (TTS) between the ages of 2 and 5, a period of pronounced developmental advances in social understanding and self-regulation, but also

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a period of limited social skills (Volling, 2012). Thus, the TTS may be particularly challenging for young children to socially engage their infant siblings in a sensitive and responsive manner during initial interactions (Mendelson, 1990). Early social behaviors toward infant siblings in the month following the birth predicted the quality of sibling interaction at the end of the first year (Dunn & Kendrick, 1982). Few studies, however, have charted longitudinal trajectories in children's social behaviors toward their infant siblings in the year following the sibling's birth. To address this research gap, we examined individual differences in firstborns' patterns of early social interactions with their infant siblings from 4 to 12 months; we further investigated the processes by which child, parent, and family factors were associated with these distinct patterns. In the remainder of this paper, we refer to firstborns as children and the secondborn infants as siblings.

To address patterns of social interaction, we drew from the conceptual framework of Horney (1945) and Caspi, Elder, and Bem (1988) that posits various ways in which individuals interact with their social world: *moving toward, moving against, and moving away*. For example, some children positively engage in social relationships, moving *toward* the world with prosocial behavior and positive social interactions. Others engage in conflict or antagonistic behavior, moving *against* the world. Still, other children withdraw and isolate themselves from social engagement, moving *away* from the world. In the current study, we examined simultaneously children's positive engagement (*moving toward*), direct antagonistic behavior (*moving against*), and avoidance of social interaction with their infant siblings (*moving away*) to examine the complexity of children's emerging sibling relationships.

One reason for examining multiple social dimensions simultaneously is that sibling relationships are often characterized as emotionally ambivalent with frequent shifts between intense positive and negative interactions (Dunn, 1983). Despite the fact that children's interactions with their siblings involve both positive and negative behaviors, most studies analyze these different aspects of sibling interaction (e.g., cooperation or conflict) separately. Further, Dunn and Kendrick (1982) argued that there was no one universal pattern of children's social behavior toward their infant sibling in the first year, and that there were large individual differences in sibling interactions. To fully appreciate the complexity of sibling interactions, multiple dimensions of social behavior need to be simultaneously examined. Children may be jealous of their infant sibling at some point and engage in antagonistic behaviors to a certain extent, but children differ in whether antagonism occurs in the context of high or low levels of positive engagement, as well as both the onset and duration of antagonistic behavior in the first year. Among the few studies that have examined multiple dimensions of sibling relationships simultaneously, McGuire, McHale and Updegraff (1996) created four different sibling relationship groups based on high and low levels of both warmth and hostility in middle childhood (2x2 design; e.g., high warmth/low hostility, low warmth/high hostility). Children in "hostile" sibling relationships (high conflict and low warmth) rated their sibling and parent-child relationships more negatively compared to children in "affect-intense" sibling relationships (high hostility and high warmth). The current study sought to identify distinct trajectory patterns in children's social interactions with their infant siblings from 4 to 12 months after birth by

simultaneously examining positive engagement, antagonistic behavior, and sibling avoidance.

Child, Parent and Family Factors Predicting Trajectories of Sibling Interaction

Bronfenbrenner and Morris (1998) proposed a *process* × *person* × *context* × *time* modelthat includes person (individual characteristics), context (environments), time (longitudinal progression), and proximal processes (complex reciprocal interactions between person and environment) when predicting developmental outcomes. Several researchers have argued for a process-oriented approach that addresses the interplay between child, parent, and family factors in predicting sibling relationship quality (McHale, Updegraff, & Whiteman, 2012; Volling, 2012). For example, studies have shown that children's temperamental characteristics and parenting behaviors were better predictors of sibling relationship quality than family structural variables such as birth order, age space, and gender (Buhrmester & Furman, 1990; Stocker, Dunn, & Plomin, 1989; McGuire et al., 1996). With the goal of uncovering the processes by which child, parent and family factors were associated with the longitudinal trajectories of children's sibling interactions, we tested a path model examining the extent to which children's temperament (child), parental self-efficacy (parent), and parental discipline (context, process) were associated with the resulting sibling trajectories (time, longitudinal progression).

With the birth of a second child, parents must learn how to balance child care for two children. Their ability to efficiently manage child care routines is likely to result in less family disruption after the birth. Further, parents' sense of efficacy in managing disruptive child behaviors most likely plays a role in how children will relate to their sibling because if parents feel competent in their childrearing, they are more likely to engage in positive, supportive parenting behavior (Simons, Beaman, Conger, & Chao, 1993). When parents felt less competent in childrearing, they were less positively engaged with their children (Roskam & Meunier, 2012), which could, in turn, carry over into children's social interactions with their sibling.

During the TTS, a child's difficult temperamental predisposition as well as parenting stress may contribute to low parental self-efficacy. For example, Volling (2012) posited that temperamentally reactive children (e.g., negative emotionality, difficult to soothe) would be more susceptible to the changes and disruptions in the family environment following the TTS. Empirically, Dunn, Kendrick, and MacNamee (1981) reported that children with difficult temperaments (e.g., intense expression of negative mood) displayed more withdrawal, clinginess, and sleep problems after the sibling's birth than did less temperamentally difficult children. Parents faced with the demanding behavior of a temperamentally difficult child while struggling to balance child care for the two children may experience greater feelings of parental incompetence and possibly use more punitive parenting practices.

How parents respond to misbehavior in order to manage sibling conflict will also have repercussions for future sibling interaction (Brody, 1998; McHale, Updegraff, & Whiteman,

2012; Volling, 2012), especially given the prevalence of sibling conflict in early childhood (Recchia & Howe, 2009). Young children interact frequently with their siblings and are likely to have many opportunities for conflict and positive engagement. Numerous studies have reported an increase in maternal control and prohibitions with children across the TTS (Baydar et al., 1997; Dunn & Kendrick, 1982). Because harsh and authoritarian parenting has been linked to more sibling conflict (McHale et al., 2012), punitive parenting might lead to children's increasing antagonism toward the infant in the subsequent year following the birth. Mothers also spend a considerable amount of time caring for the newborn infant after the TTS, so fathers may play a more prominent role in the daily care of firstborn children (Volling, 2005). Therefore, it is important to include both mothers and fathers in a single analysis.

Previous studies have examined the links between parental self-efficacy (PSE) and children's behavior. For example, PSE directly influenced children's behavioral patterns (Ardelt & Eccles, 2001) and contributed to a greater likelihood of punitive parental discipline in response to children's misbehaviors (Roskam & Meunier, 2012). We addressed the direct effects of PSE and punitive parenting on the firstborns' negative behavior toward the infant sibling, as well as the indirect effect of PSE on sibling interactions through punitive parenting. Additionally, we tested the associations between family constellation variables such as birth order, age spacing, and the gender constellation of the sibling dyad on the trajectories of sibling interaction because some studies report relations between sibling relationship quality and family constellation variables, although findings are often inconsistent (e.g., Buhrmester & Furman, 1990; Deater-Decker et al., 2002; Dunn, 1983).

Research Overview

The aims of the present study were twofold. First, we sought to examine different patterns of sibling interaction by identifying subgroups (or classes) of children showing similar developmental trajectories during the first year following the sibling's birth. Second, guided by a *process* × *person* × *context* × *time* model, we examined a path model to uncover the processes by which child, parent, and family factors were associated with the development of children's sibling interactions with an infant sibling in the first year. To these ends, we utilized a hybrid-approach by incorporating a person-centered approach (GMM) to identify our classes based on the multiple sibling dimensions (i.e., positive engagement, antagonism, avoidance), as well as variable-centered and process-oriented approaches (path model) to uncover the processes. Given that no previous study has charted developmental trajectory patterns of children's interactions with their infant siblings, no specific hypotheses were advanced. Based on the few available cross-sectional studies using person-centered approaches to identify typologies of sibling relationships (e.g., Hetherington, 1988; McGuire et al., 1996), we anticipated that there would be significant heterogeneity that would give rise to subgroups of children sharing similar trajectory patterns (e.g., high on positive engagement and antagonism, but low on avoidance; or high on positive engagement but low on both antagonism and avoidance; or low on positive engagement and antagonism, but high on avoidance). We hypothesized that punitive parenting and low parental self-efficacy would be exacerbated under high levels of parenting stress and by more difficult child temperament, and that more punitive parenting and lower parental self-efficacy would

directly and indirectly increase the likelihood of antagonism toward and avoidance of the sibling over time.

Method

Participants

Study participants (*n* =213 families of firstborn children, mothers and fathers) were drawn from a larger study of 241 families recruited for a longitudinal investigation of changes in family functioning after the birth of a second child. Women were initially recruited from obstetric and family medicine clinics affiliated with a large Midwestern university health care system, childbirth education classes, and advertisements in local parenting magazines. Eligible families had to meet the following criteria: (1) mothers were expecting their second child; (2) fathers were resident and living with mother; (3) firstborn children were between the ages of 1 and 5 at the time of the infant's birth; and (4) both infants and children were free of physical and developmental delays, and preterm births. Families were mostly white (85.9% for mothers and 86.3% for fathers), with 14% reflecting other ethnic backgrounds (5% African American; 3% Asian American; 3% Hispanic; and 3% other). The median household income was between $80,000 and $85,000 and median levels of education for both mothers and fathers included a Bachelor's degree or higher. The average age of mothers was 31.6 years (*SD* = 4.22), the average age of fathers was 33.2 years (*SD* = 4.78), and the average age of older children was 29.92 months at recruitment (prenatal timepoint). About 45.6% of the firstborn children and 55% of the infant siblings in the study were boys.

Procedures

Data were collected during the last trimester of the mother's pregnancy with a second child and throughout the first year after the birth (i.e., prenatal, 1-, 4-, 8-, and 12-months). Data for the current report were taken from mothers' and fathers' reports of sibling interaction obtained at 4, 8 and 12 months; parenting stress and child temperament prenatally; parenting self-efficacy at 1 month postpartum; and parental discipline at 4 months.

The attrition rate from the prenatal visit to the 12 month time point was 15%. The sample used in the analyses (*n* = 213) included those families who participated at the 4-month time point and for which we had parent reports of sibling interaction. These families were significantly different from the recruited sample (*n* = 241) on fathers' education ($\chi^2 = 10.78$, *df* = 3, *p* = .01); fathers remaining in the study were more educated than fathers who had dropped. There were no significant differences for family income, mother's education, mother's race/ethnicity, father's race/ethnicity, gender of child or infant, years of marriage, mother's age, father's age, or firstborn's age.

Measures

Sibling relationships—The Sibling Relationships in Early Childhood questionnaire (SREC, Volling & Elins, 1998) was used to assess children's social behavior toward their infant sibling at the 4-, 8-, and 12-month time points. Both mothers and fathers completed the 18 items, using a 5-point Likert scale (1 = *never* to 5 = *always*). The SREC yields three subscales: *Positive engagement* (e.g., "my firstborn child often initiates play or interactions

with the baby"); *Antagonistic behavior* (e.g., "is cruel or does mean things to baby"); and *Avoidance* (e.g., "stays away from baby if possible"). Because we wanted to utilize multiple informants and mothers' and father's reports were significantly correlated across scales and timepoints (*r*s = .40 - .52 for positive engagement, .43 - .51 for antagonism, and .28 - .40 for avoidance, all *ps* < .001), composite scores were created by averaging mothers' and fathers' reports (αs = .86, .73, and .52. for positive engagement, antagonistic behavior and avoidance, respectively). Correlations among the variables at 4-, 8-, and 12-month timepoints ranged from .67 - .76 (positive engagement), .37 - .61 (antagonism), and .46 - .58 (avoidance), all *ps* < .001.

Children's temperament—At the prenatal timepoint, mothers and fathers completed 62 items of the Child Behavior Questionnaire (CBQ, Rothbart, Ahadi, Hershey, & Fisher, 2001) using a 7-point Likert scale (1 = *extremely untrue*; 7 = *extremely true*) to assess children's temperament. Only the 13- item *anger/frustration* scale (α = .77 and .73 for mothers and fathers, respectively) and 13-item *soothability* (reverse scored) scale (α = .77 and .75 for mothers and fathers, respectively) were used. A composite score was created by averaging mothers' and fathers' reports to reflect children's dysregulated temperament.

Parenting stress—At the prenatal timepoint, mothers and fathers completed the 14 items of the Parenting Daily Hassles scale (PDH, Crnic, & Greenberg, 1990) using a 5-point Likert scale; 1 = *no hassles* to 5= *huge hassles*). Items were modified so they focused specifically on the firstborn child and yielded two subscales: *parenting tasks hassles* (e.g., "you continually have to clean up after your older child's messes"; α= .69, .70 for mothers and fathers, respectively) and *children's challenging behavior hassles* (e.g.,"older child demands to be entertained or played with"; α= .75, .75 for mothers and fathers, respectively). A composite score was created by averaging mothers' and fathers' reports.

Parental self-efficacy—At 1 month postpartum, mothers and fathers completed 47 items of the Parental Locus of Control Scale (PLOC, Campis, Lyman, & Prentice-Dunn, 1986). The PLOC uses a 5-point Likert scale ranging from (1) *strongly disagree* to (5) *strongly agree* to measure parental self-efficacy which yields five subscales. A composite score was created by averaging mothers' and fathers' reports on three subscales because they reflected parents' feelings of confidence in their parenting abilities and specifically whether they felt competent in controlling children's misbehaviors: (a) *parental self-efficacy* (10 items; e.g., "what I do has little effect on my older child's behavior"; α= .76 and .67 for mothers and fathers, respectively), (b) *child control of parents' life* (7 items; e.g., "my life is chiefly controlled by my older child" ; α= .65 and .62 for mothers and fathers, respectively)', and (c) *parental control of child's life* (10 items; e.g., "my older child's behavior is sometimes more than I can handle"; α= .82 and .81 for mothers and fathers, respectively).

Punitive parenting—A modified version of the How Do You Manage Children's Conflict Scale (Perozynski & Kramer, 1999) was completed by mothers and fathers asking how they managed children's misbehaviors toward the infant sibling at the 4-month timepoint using a 3-point Likert scale (1 = *almost never*, 2 = *sometimes*, 3 = *usually*). Based on our interest in parents' use of harsh and controlling management strategies, we focused on the 9-item

parent-centered control subscale to reflect punitive parenting (e.g., "told my older child that she/he would be punished if she/he did not stop misbehaving, fully intending it", "used a form of physical punishment to stop my older child's misbehavior"; α = .75 and .74 for mothers and fathers, respectively). A composite score was created by averaging mothers' and fathers' reports.

Demographic information—Information on family household income, mothers' and fathers' education, and gender and birthdate of the firstborn children was collected at the prenatal timepoint; gender and the birthdate of the infants was collected at 1 month postpartum.

Data Analysis Plan

The primary research question focused on identifying distinct longitudinal patterns of children's interactions with their infant siblings starting at 4 months after the birth. We first fit an unconditional Latent Growth Curve Model (LGCM) with three parallel processes (positive engagement, antagonism and avoidance) to test the linear growth trajectories with both fixed and random effects (i.e., variability) for the intercept and linear slope. We then used Growth Mixture Modeling (GMM) with three-parallel processes to simultaneously examine the three social dimensions: Positive engagement, antagonistic behavior and avoidance. Given the variability noted in sibling relationship quality (Dunn & Kendrick, 1982), the GMM allowed us to determine whether there were different groups of children showing similar trajectory patterns. Next, we examined the processes by which child and family factors were associated with the sibling trajectory patterns using a path model. Finally, we examined family constellation effects to test whether the sibling relationship trajectory patterns differed (1) by gender composition of the sibling dyads (χ^2 test) and (2) in the age spacing between the firstborns and infant siblings (one–way ANOVA).

Growth mixture model with three-parallel processes—Of great interest was identifying distinct developmental patterns of children's sibling interactions *across* the three dimensions (i.e., positive engagement, antagonistic behavior and avoidance). We used GMM with three-parallel processes (Muthén & Muthén, 2000) to identify groups of children who exhibited similar trajectory patterns (see Figure 1). Data analysis was conducted using *Mplus Version 5.21* (Muthén & Muthén, 1998-2010). For each parallel process (i.e., positive engagement, antagonistic behavior, avoidance), time was centered at the 4-month timepoint, and paths from the latent intercept to the observed items were constrained to be 1 for each timepoint. The paths from the latent linear slope to the observed items were constrained to be 0, 1, and 2, which corresponded to the 4-, 8-, and 12-month time-points, respectively. The GMM included random effects for both intercepts and slopes, which allowed for heterogeneity in both random effects and classes. The fixed effects and random variances for the growth parameters (i.e., intercept, linear slope) were freely estimated for each class. The estimated fit indices for 1(unconditional model)-to-*k*+1 class-solution models are presented in the results below. Models were evaluated to determine which model, and hence number of classes, provided the best fit to the data. Because different models are not nested, model comparisons were conducted using a set of fit indices, including the Bayesian Information Criterion (*BIC*; Schwartz, 1978), the sample size adjusted *BIC* (*SSA BIC*; Sclove, 1987), and

the Akaike Information Criterion (*AIC*; Akaike, 1987); lower scores represent better fitting models. We also used the Lo-Mendell-Rubin (LMR) likelihood ratio test of model fit and entropy which refers to the average classification accuracy in assigning individuals to classes; values range from zero to 1, with higher scores reflecting better accuracy in classification of class membership. The optimal model was chosen based on goodness-of-fit indices and parsimony.

Path analysis—Once the distinct trajectory patterns (i.e., classes) had been determined, we tested a path model that encompassed children's dysregulated temperament, parenting stress from daily hassles, PSE, and punitive parenting to predict children's sibling interaction patterns toward their infant siblings. In the model, we included the firstborns' age and family demographic variables such as mothers' and fathers' education, and family household income as covariates.

Missing Data—In the GMM with three-parallel processes, models were estimated in *Mplus 5.21* using full-information maximum-likelihood (FIML) estimation. A path analysis was conducted using Maximum Likelihood with robust (MLR) estimation with Monte-Carlo integration due to a nominal outcome variable (Muthén & Muthén, 1998-2010).

Results

The results are presented in two parts. First, we describe developmental trajectories of children's social interactions with their infant siblings using the dimensions of positive engagement, antagonistic behavior, and avoidance. Second, we present a path model that addressed the processes by which child, parent and family factors were associated with the trajectory patterns (i.e., class membership).

We examined the unconditional latent growth curve model (LGCM) with three parallel processes to identify overall intra-personal changes based on the initial level and the rate of change in sibling relationship dimensions (positive engagement: PE; antagonism: ANT; and avoidance: AV) during interactions with their infant siblings. The fixed effects for the slopes of antagonism and avoidance were significant indicating an overall linear increase in antagonism (est.=.37, *SE* = .03, $p < .001$) and avoidance (est.=.07, *SE* = .02, $p < .01$) for the entire sample. The random effects indicated that there was substantial variability around the intercepts of all three dimensions (est.=.21, 21, .07, *SE* = .03, .04, .02, all *ps* < .001, for PE, ANT and AV, respectively) and the slope of antagonism (est.=.07, *SE* = .02, $p < .001$), providing the basis for delving further into the identification of distinct sibling relationship patterns. Turning to the GMM analysis, we longitudinally examined children's distinct social trajectory patterns for positive engagement, antagonistic behavior, and avoidance simultaneously. Based on fit indices, we determined the three-class model was the best fit (AIC = 1971.4, BIC = 2179.8, SABIC = 1983.4, Entropy = .72, LMR-LRT *p*-value = .240) over the 2-class (AIC = 1987.6, BIC = 2152.3, SABIC = 1997.0, Entropy = .60, LMR-LRT = .197) and 4-class models (AIC = 1972.6, BIC = 2164.2, SABIC = 1983.6, Entropy = .87, LMR-LRT = .673; note that the 4-class model showed negative variances in the random effects for slope). Figure 2 presents the trajectory patterns for each of the three classes and Table 1 presents the GMM parameter estimates that allow interpretation of the class

patterns. The first class (C1) represented 50% of the sample (n = 107)and was labeled the *positively-engaged* class. C1 children showed high levels of positive engagement with the infant sibling that increased over time, as well as low levels of antagonistic behavior that increased gradually from 4 to 12 months and low levels of avoidance that also showed a slight increase over time. The second class (C2) was labeled the *escalating-antagonism* class (42%, n = 90). Not only did C2 children have the lowest levels of positive engagement with no noticeable change over time, but they differed from C1 children predominantly because of the steep linear increase in antagonism from 4 to 12 months, and a linear increase in avoidance over time. Finally, the third and smallest class (C3, 8%, n = 16) showed a unique pattern whereby children displayed relatively high, stable levels of positive engagement over time, but they differed from the other two classes in two ways: a) the high level of antagonistic behavior starting at 4 months that remained stable over time; and b) the lowest level of avoidance at 4 months that increased steeply over time. We labeled this third class the *early-onset antagonism* class.

We conducted Wald z-tests to examine whether the differences in intercepts and slopes were statistically significant across classes. The intercept of positive engagement in the *escalating-antagonism* (C2) class was significantly lower than those in both the *positively-engaged* (C1) and *early-onset antagonism* (C3) classes, $z = 3.488$, $p < .001$. The intercept of avoidance in the *early-onset antagonism* (C3) class was significantly lower than those in both the *positively-engaged* (C1) and *escalating-antagonism* (C2) classes, $z = 3.035$, $p < .001$. The slope of antagonism in C2 (*escalating-antagonism*) was significantly greater than that of C1 (*positively-engaged*), showing that C2 children had a steeper increase in antagonistic behavior over time, relative to C1 children, $z = 5.303$, $p < .001$. The slope of avoidance in the C3 (*early-onset antagonism)* was significantly greater than those of C2 and C1, indicating that C3 children showed a steeper increase in avoidance over time, $z = -3.906$, $p < .001$.

Predicting Class Membership: Testing a Path Model of Child, Parent, and Family Factors

We further investigated the child and parent antecedents of the different trajectory groups, focusing on child (temperament), parent (parental self-efficacy, punitive parenting, parental stress) and demographic characteristics in building our path model. Due to the class membership being a categorical outcome variable in the path analysis, we designated the largest *positively-engaged* class (C1) as the reference class in multinomial logistic regression models. Coefficients can be interpreted as the log odds of membership in either the *escalating-antagonism* class (C2) or early-onset antagonism class (C3), relative to the *positively-engaged* class (C1), for one unit increase in the predictor. The firstborns' age and family demographics (family household income, mothers' and fathers' education) were included as controlling covariates in the path model. Our proposed path model tested whether prenatal parental stress and prenatal children's dysregulated temperament contributed to a lack of parental self-efficacy at 1 month that, in turn, predicted the trajectory classes both directly and indirectly through punitive parental discipline at 4 months. Because the direct paths from both child temperament and parenting stress to sibling relationship patterns were not significant, these two paths were dropped. The final path model is shown

in Figure 3, and descriptive statistics for the study variables are presented in Table 2 (The full correlation matrix is available from the authors).

The findings showed that prenatal parenting stress and children's dysregulated temperament were significantly related to lower parental self-efficacy (PSE) at 1month postpartum. Further, multinomial logistic regression analyses within the path model revealed the direct effects of both PSE and punitive parental discipline in predicting trajectory classes. Specifically, low PSE differentiated the *escalating antagonism* class from the *positively-engaged* class, the reference class. That is, children whose parents felt less efficacious at 1 month postpartum had a greater likelihood of being in the *escalating-antagonism* class, relative to the *positively-engaged* class (est.=1.264, *SE*= .47, *p*= .007; OR=3.54). Children whose parents used punitive parenting at 4 months in response to children's misbehaviors directed at their siblings were more likely to be in the *early-onset antagonism* class, relative to the positively-engaged class (est.=2.706, *SE*= .77, *p*= .000; OR=14.97). The punitive parenting also discriminated the *escalating antagonism* class from the *positively-engaged* class (est.=−1.209, *SE*= .53, *p*= .023; OR= .30). In addition, we tested the indirect effects of PSE on sibling trajectory patterns through punitive parenting (i.e., mediation effect of punitive parenting). Although the direct effect of PSE was significantly predictive of the C2 escalating antagonism class, there was no significant indirect effect of PSE on sibling trajectory patterns through punitive parenting. A similar pattern emerged for PSE and punitive parenting when we ran ANOVAs with sibling class as the between group factor (see Table 2). Although main effects for class were significant for both PSE and punitive parenting, Tukey's post-hoc comparisons revealed that only the parents in the early-onset antagonism class (C3) had significantly higher punitive parenting than those in both the positively-engaged (C1) and escalating antagonism (C2) classes.

Family Constellation Effects on Class membership

As a final approach to examining correlates of trajectory patterns (i.e., class membership), we examined the family structural variables of birth spacing and gender composition. The distribution of classes was not significantly different as a function of the sibling dyads' gender, $\chi^2 = 4.42$, $df = 6$, $p = .62$ (the firstborn – secondborn dyads was: 52 girl – girl, 63 girl – boy, 45 boy – girl, and 53 boy – boy), nor did they differ with respect to the birth spacing between siblings (i.e., child's age at the birth of a sibling), $F = 1.43$, $df = 2$, $p = .24$ (M=31.8 months, SD=10.2 for C1; M=29.3, SD=10.6 for C2; M=30.9, SD=7.8 for C3).

Discussion

The current study examined longitudinal trajectory patterns of children's social interactions with their infant sibling following the transition to siblinghood (TTS) using a multi-dimensional approach where we considered simultaneously positive social engagement, antagonism, and social avoidance. Further, we addressed the family processes by which child and parent factors come into play to determine different patterns of children's social interaction with their siblings. The present investigation addressed several research gaps and yielded several interesting findings.

First, using Growth Mixture Modeling with three-parallel processes we identified three patterns of children's social interactions with their infant sibling in the first year after the sibling's birth. This included: (a) *positively-engaged* (C1); (b) *escalating-antagonism* (C2); and (c) *early-onset antagonism* (C3) classes. Children in all classes were more positively engaged in interaction with their infant siblings than they were antagonistic or avoidant. There was evidence of increases in avoidance across all three classes, but the classes differed predominantly in the level of antagonism and the timing at which antagonism was highest (e.g., onset; duration).

Approximately half of the children (50%) could best be described as *positively-engaged.* Most children evinced high levels of positive engagement with their infant siblings with little antagonistic behavior and avoidance. This largest and perhaps normative class of children not only was high in positive engagement, but also showed an increase in positive engagement over time, which was not the case in the other two classes. In addition, there was also a significant increase in both antagonism and avoidance over time, although both remained relatively low in C1 children compared to the C2 and C3 children. This may reflect normative characteristics of sibling relationships which have been described as emotionally ambivalent (Dunn, 1983) with frequent shifts between positive and negative interaction. The significant increases in children's positive, antagonistic and avoidant behaviors over time may also be due to the changing developmental abilities of their infant siblings as they become more mobile and can initiate both positive and negative social interactions by the end of the first year (Recchia & Howe, 2009).

The two other classes displayed different patterns of social interaction that differed mostly in antagonism. Approximately 40% of children exhibited an *escalating-antagonism* trajectory where children showed a steeper increase in their antagonistic behaviors coupled with a lower level of positive engagement with their infant siblings than C1 children. They also had a greater rise in avoidance starting at 4 months. Bank, Patterson and Reid (1996) argued that low quality sibling relationships characterized by frequent conflict, coercive interactions, and low positivity may set the stage for training children in antisocial behavior. Because of the increasing maturity of infants over time and their ability to initiate more positive and negative interactions by the end of the first year, we would expect some increase in antagonism to be normative. C2 children's antagonism, however, increased sharply in comparison to the other two classes and without further follow-up, we are unable to determine whether the increase in antagonism for C2 children is problematic and a cause for concern. In any event, the sudden increase in antagonistic behavior no doubt placed a different burden on C2 parents than in families where the increase was not so dramatic.

The final pattern represented only 8% of children, but appeared more problematic than the C1 and C2 children because of the *early-onset of antagonistic behavior* toward their infant siblings. These children were already exhibiting higher levels of antagonistic behavior toward their infant siblings by 4 months that remained high over time. Although the firstborn children in this class showed high levels of positive engagement, they also showed a significantly steeper increase in avoidance over time. Although small in size, the identification of the early-onset antagonism class is particularly notable because the early-onset antagonistic behavior coupled with positive engagement may indicate the emergence

of disruptive sibling dynamics in early childhood. Such negative interactions coupled with positivity might set the stage for further difficulties in the sibling relationship. For example, earlier studies indicated that both positive and negative interactions that reinforced each sibling's disruptive behavior through shared positive affect were likely to result in further coercion and sibling collusion (Bullock & Dishion, 2002). Although sibling collusion processes have been studied mostly in adolescence, our findings suggest that children's social tendencies to positively engage, avoid, or antagonize their infant siblings emerge early in life. Among the few available studies that examined siblings' disruptive interactions in early childhood, Garcia et al. (2000) identified the early emergence of sibling coercion and prolonged sibling conflict at 5 to 6 years of age (Garcia, Shaw, Winslow, & Yaggi, 2000). Alternatively, the early-onset antagonism class may reflect a rather extreme emotionally ambivalent (e.g., love-hate relationships) sibling relationship (Dunn, 1983). Further study is needed to determine how these early social behaviors may contribute to long-term patterns of sibling relationship trajectories and related developmental outcomes.

We also tested whether the distinct sibling relationship patterns differed due to family constellation effects. Similar to other studies (Abramovitch et al., 1986; Dunn & Kendrick, 1982; McGuire et al., 1996; Stocker et al., 1989), we found no evidence that the sibling trajectory patterns differed based on gender composition of the sibling dyads and the age spacing between the siblings (i.e. the effect of the firstborns' age), although other studies have reported such effects (e.g., Deater-Deckard, Dunn, & Lussier, 2002; Dunn et al., 1999; Hetherington et al., 1999). Recent efforts, however, suggested the need for a more process-oriented approach to understanding the development of sibling relationships rather than relying on family structural variables (e.g., Kramer & Conger, 2009; McHale et al., 2012; Volling 2005, 2012). Thus, other family processes must account for why children engaged in different social interaction patterns with their infant siblings in the current investigation.

Predicting Sibling Trajectory Patterns from Child, Parent, and Family Processes

In an effort to examine how child, parent and family processes predicted the different trajectory patterns, we tested path models that encompassed various direct and indirect paths between child, parent, and family factors. Thus for some parents, children's difficult temperament contributed to parents' feelings of incompetence in handling their children's misbehavior particularly during a time of stressful transition (Cutrona &Troutman, 1986; Dunn, Kendrick, & MacNamee, 1981). Kolak and Volling (2011) found that preschool siblings' behavioral dysregulation in response to mother-sibling interaction predicted observed negative affect during sibling interaction 4 years later. Kennedy and Kramer (2008) found that improved emotion regulation resulting from an intervention targeting the sibling dyad (4-8 years of age) promoted more positive sibling relationships. Similarly, our study also found that children's difficult temperamental predispositions before the birth were significantly related to parental feelings of low self-efficacy in handling their children's misbehaviors 1 month after the birth.

Although studies of the etiology of behavior problems have considered negative emotionality as a general risk factor for the development of children's problem behaviors (e.g., Eisenberg, Fabes, Guthrie & Reiser, 2000), the interplay of temperamental and

environmental (e.g., parenting) factors often predicts problem behaviors (e.g., Kochanska, Aksan, & Joy, 2007). It may be the combination of a difficult child and the changes associated with the TTS that may add considerable stress for parents as they attempt to manage the care of a new infant and the demanding and difficult behavior of an older child. These increasing demands and parenting stresses could very well lead to a lower sense of parental self-efficacy where parents feel incapable of controlling their children.

In the current study, not only did parenting stress and children's difficult temperament converge to predict lower parental efficacy at 1 month after the birth, but lower parental efficacy predicted children's placement in the e*scalating-antagonism* class relative to the positively-engaged class. This finding is also consistent with Ardelt and Eccles (2001) who reported that parental self-efficacy directly influenced children's self-efficacy and academic success in low-income families. Children in the escalating-antagonism class represented the lowest level of positive engagement in conjunction with a surge in sibling hostility and conflict over time (with the highest level of antagonistic behavior at 12 months). We hypothesized that how parents managed these early social interactions between older children and the infant siblings would be related to the developing trajectories of sibling interaction. Consistent with extant literature (Jones & Prinz, 2005; Roskam &Meunier, 2012; Simons, Beaman, Conger, & Chao, 1993), our findings indicated that low PSE was significantly related to more punitive, controlling parental discipline in response to children's misbehaviors with their infant siblings.

Further, the more parents used punitive control as a form of discipline, the more likely children were in the *early-onset antagonism* class, relative to the positively-engaged class. Patterson's early work on family coercion (1984) argued that siblings were also aversive in sibling interactions, especially initiations, when parents used harsh, coercive forms of discipline. In fact, our findings indicated that punitive parenting differentiated the *early-onset antagonism* class from the positively-engaged class. From a developmental perspective, this finding is especially notable because older siblings can train younger children to be coercive by modeling and then reinforcing aversive behavior within the family where parents use harsh, coercive parenting practices (Garcia et al., 2000; Patterson, 1984). Although the current investigation did not examine the causal relations between parenting and sibling interaction, when children experience parental punitive discipline in the context of sibling interactions, it is possible that they inadvertently learn aversive, coercive interaction patterns within the family.

Interestingly, although the direct effects of both PSE and parental discipline were significant in predicting sibling trajectory patterns, we did not find a significant indirect effect of PSE through parents' punitive parenting on sibling relationship patterns. According to Patterson's model, harsh parenting practices are one of the primary mechanisms responsible for the initiation of coercive cycles of family interaction. Further, Bullock and Dishion (2002) found that coercive parenting practices had direct effects on children's problem behavior. In future studies, it would be especially important to examine the links between harsh parenting, coercive sibling interactions and conduct problems.

Taken together, the present findings highlighted the heterogeneity in children's social interactions with their infant sibling in the first year after the birth of a sibling, evidenced in the different trajectory patterns involving positive engagement, antagonistic behaviors and avoidance. The results of our path model shed light on the processes by which child, parent, and family factors contributed to different patterns of children's sibling interactions.

Strengths and limitations—One of the unique strengths of this longitudinal study was the simultaneous examination of children's trajectories of antagonistic behavior, avoidance, and positive engagement to address the various ways children interact with their infant siblings in the first year. In doing so, this study used a hybrid approach by incorporating person-centered, and variable-centered approaches to uncover *how* and *why* children respond and interact differently to their infant siblings. We used advanced modeling techniques (GMM with three-parallel processes) that allowed us to address these issues and identified heterogeneity in trajectory patterns using multiple social dimensions (positive engagement, antagonism, avoidance) over time as children made the transition to siblinghood. In addition, we examined the interplay of children's temperament, parent and family factors in predicting distinct patterns of children's social behaviors using a process-oriented path model. We also utilized multiple-informants by including both mothers' and fathers' reports on child, parent, and family variables. Despite these strengths, there are a number of limitations that should be noted. First, information on children's social behaviors were based on parental reports and not actual observations, although by including both mothers' and fathers' reports, we were able to reduce single-reporter bias. Observational data, however, also have their own limits in that there may not be adequate time sampling from which one can observe conflict or avoidance, particularly if they occur at low frequencies. Because of our interest in fathers, the sample included two-parent families, and the participants of this study were predominantly European-American and from middle-income families. Considering that the present study was based on a relatively low-risk community sample with adequate financial and educational resources (with attrition fathers remaining in the study were more educated), different trajectory patterns might have emerged in a sample of families experiencing more significant financial stress and in high-risk environments. We did not compute the GMM and path models simultaneously because we did not want the path model to influence and change class membership obtained from the GMM, which can occur with the addition of predictors into the model. Further, appropriate methods for determining latent classes from a GMM in the context of a path model simultaneously are not currently available. Another limitation is the relatively low internal consistency of some of our measures (αs = .52-.65), although including mothers and fathers whose scores were often significantly correlated, increased the robustness of our composites. All in all, the current study makes a significant contribution to our understanding of the heterogeneity in young children's sibling relationships and the family processes that give rise to individual differences in sibling interactions shortly after the birth of an infant sibling.

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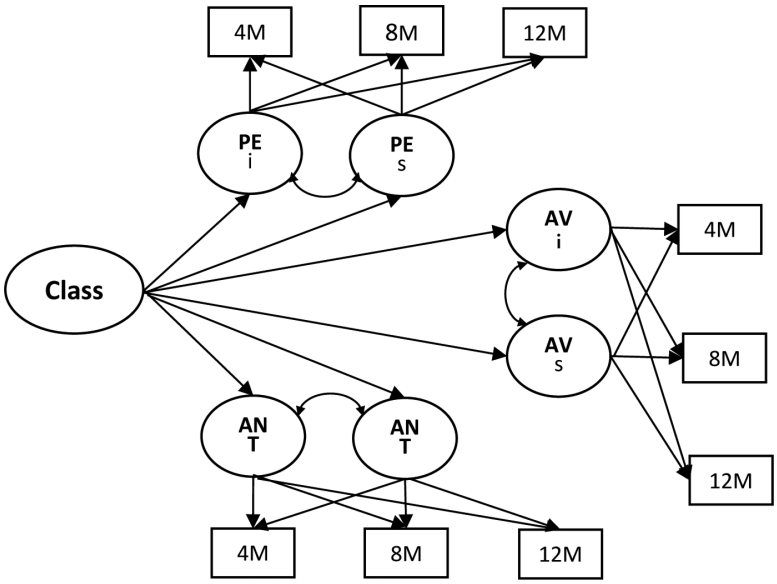

Figure 1.

Three-parallel process Growth Mixture Model (PE: Positive Engagement; ANT: Antagonistic Behavior; AV: Avoidance). Class is a latent class variable that influences the growth factors (i = intercept, s = slope) of all three parallel processes of the GMM. All the intercepts and slopes were allowed to covary but omitted for ease of presentation.

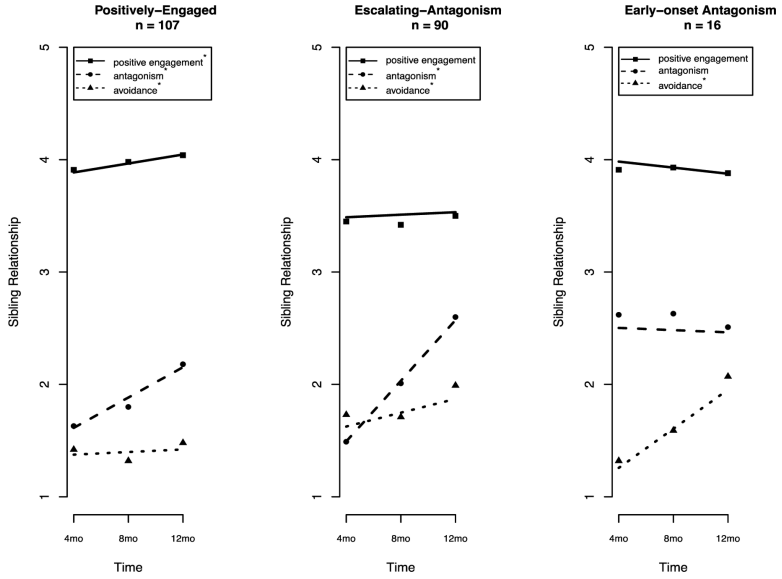

Figure 2.

Fitted mean trajectories for 3-class model from three-parallel process Growth Mixture Model (Sample means marked). * Asterisk indicates a significant slope, $p < .05$.

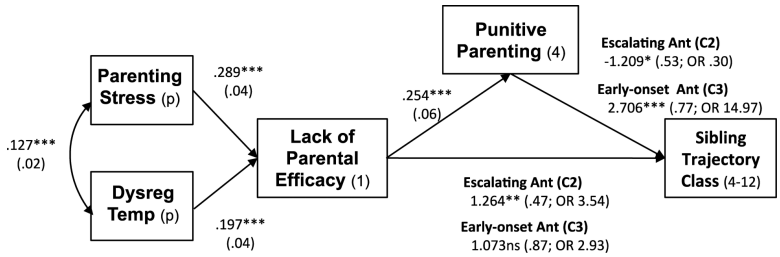

Figure 3.

Multinomial path model predicting children's sibling interaction class membership (the *Positively-Engaged* class is the reference class). Standard errors in parentheses. Variable Timepoints in parentheses (p = prenatal timepoint; 1 = 1month; 4 = 4months; 4 - 12 = 4months through 12months). SES variables (mother and father education; family household income) and the firstborns' age were included in the model as covariates. Dysreg Temp= Dysregulated Temperament at 1 month; Ant= Antagonism; OR= Odds Ratio. ns = nonsignificant. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 1

Fixed Effects Estimates and Standard Errors for 3-class Solution of GMM with Three-Parallel Processes

	Positively-Engaged			Escalating-Antagonism			Early-Onset Antagonism		
Parameter	**PE**	**ANT**	**AV**	**PE**	**ANT**	**AV**	**PE**	**ANT**	**AV**
intercept	3.886*** (0.055)	1.613*** (0.079)	1.375*** (0.047)	3.487*** (0.100)	1 492*** (0.065)	1.625*** (0.074)	3.983*** (0.151)	2.503*** (0.18)	1.257*** (0.067)
slope	0.08** (0.029)	0.27*** (0.036)	0.023 (0.045)	0.023 (0.030)	0.54*** (0.036)	0.123*** (0.030)	−0.054 (.069)	−0.02 (0.098)	0.348*** (0.065)

Note. Standard errors in parentheses. Positively-Engaged Class = C1, 50.2%, *n* = 107; Escalating-Antagonism Class = C2, 42.3%, *n* = 90; Early-Onset Antagonism Class = C3, 7.5%, *n* = 16. PE = Positive Engagement; ANT= Antagonism; AV= Avoidance.

* $p < .05$

*** $p < .001$.

Table 2

Mean Scores of Study Variables for Different Sibling Interaction Classes

Variable	Positively-Engaged (*n* = 107)	Escalating-Antagonism (*n* = 90)	Early-Onset Antagonism (*n* = 16)	Total (*N* = 213)	*F*
Sibling Relationship					
Positive Engagement (4)	3.91 [a](0.45)	3.45 [b](0.58)	3.91 [a](0.34)	3.71 (0.55)	21.08***
Positive Engagement (8)	3.98 [a](0.38)	3.42 [b](0.52)	3.93 [a](0.45)	3.74 (0.52)	39.69***
Positive Engagement (12)	4.05 [a](0.34)	3.50 [b](0.54)	3.88 [a](0.39)	3.80 (0.51)	35.05***
Antagonism (4)	1.63 [a](0.41)	1.49 [a](0.40)	2.62 [b](0.50)	1.64 (0.50)	48.42***
Antagonism (8)	1.79 [a](0.45)	2.01 [b](0.57)	2.63 [c](0.55)	1.95 (0.55)	19.73***
Antagonism (12)	2.18 [a](0.43)	2.60 [b](0.57)	2.51 (0.59)	2.39 (0.54)	15.74***
Avoidance (4)	1.42 [a](0.34)	1.73 [b](0.49)	1.32 [a](0.17)	1.54 (0.43)	17.27***
Avoidance (8)	1.32 [a](0.25)	1.71 [b](0.51)	1.59 [b](0.30)	1.51 (0.43)	25.40***
Avoidance (12)	1.48 [a](0.32)	1.99 [b](0.56)	2.07 [b](0.51)	1.74 (0.52)	32.92***
Child and Parent Factor					
Child Dys. Temp (p)	3.58 (0.54)	3.61 (0.54)	3.80 (0.59)	3.61 (0.54)	1.12
Parental Stress (p)	2.24 (0.50)	2.30 (0.46)	2.45 (0.60)	2.28 (0.49)	1.37
Lack of Parental Efficacy (1)	2.06 (0.32)	2.16 (0.32)	2.25 (0.26)	2.12 (0.32)	3.72*
Punitive Parenting (4)	1.62 [a](0.31)	1.55 [a](0.27)	1.93 [b](0.31)	1.62 (0.31)	10.85***

Note. Standard Deviation in Parentheses. Positively-Engaged Class = C1; Escalating-Antagnism Class = C2; Early-Onset Antagonism Class = C3. Variable Timepoints in parentheses (p = prenatal timepoint; 1 = 1month; 4 = 4months; 8 = 8 months; 12 = 12months). Dys. Temp=Dysregulated Temperament. Means designated with different superscripts are significantly different from each other based on post-hoc Tukey comparisons.

* $p < .05$

*** $p < .001$.