

## Aggression, Sibling Antagonism, and Theory of Mind During the First Year of Siblinghood: A Developmental Cascade Model

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A developmental cascade model was tested to examine longitudinal associations among firstborn children's aggression, theory of mind (ToM), and antagonism toward their younger sibling during the 1st year of siblinghood. Aggression and ToM were assessed before the birth of a sibling and 4 and 12 months after the birth, and antagonism was examined at 4 and 12 months in a sample of 208 firstborn children (initial  $M_{\text{age}} = 30$  months, 56% girls) from primarily European American, middle-class families. Firstborns' aggression consistently predicted high sibling antagonism both directly and through poorer ToM. Results highlight the importance of examining longitudinal influences across behavioral, social-cognitive, and relational factors that are closely intertwined even from the early years of life.

Childhood aggression peaks during toddlerhood, followed by a decline around age 3 (Alink et al., 2006; Tremblay et al., 2004). Despite the general decrease in early aggressive behavior, some children continue to show a high stable pattern of aggression into school age, which is associated with a range of poor social and academic outcomes (Caspi & Moffitt, 1995). Because early-onset conduct problems can be identified as early as at age 3 (Shaw & Gross, 2008), research on the correlates of early aggression can help inform preventative interventions that seek to target at-risk young children (e.g., Hyde et al., 2013).

There are multiple family- and child-level factors that are associated with the development of young children's aggression. Siblings, in particular, are influential social agents for developing aggression during toddlerhood and the early preschool years. Sibling antagonism, which refers to aggressive or hostile acts directed toward siblings, is related to,

yet distinct from, a general disposition toward aggression (Volling & Elins, 1998), even though the two are often related in research studies (see Dirks, Persram, Recchia, & Howe, 2015, for review; Garcia, Shaw, Winslow, & Yaggi, 2000). Destructive and coercive sibling interactions can serve as a training ground for aggressive children, providing opportunities to practice and learn a wide range of antisocial behaviors (Patterson, 1986). In addition to social influences, child characteristics are also relevant for understanding the progression of aggression, with recent research finding relations between aggression and children's theory of mind (ToM), suggesting that aggressive children have poorer (i.e., slower in the developing pace) ToM compared to their peers (Lane et al., 2013; Wellman, Lane, LaBounty, & Olson, 2011). Furthermore, a number of studies have found a significant positive association between children's ToM development and sibling relationship quality (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Hughes & Ensor, 2006). The main goal of the current study was to examine the reciprocal relations between firstborn children's aggression, ToM, and sibling antagonism in the year following the birth of their infant sibling.

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*Aggression and Early Sibling Antagonism*

Sibling relationships begin within the 1st months following the birth of a sibling.

Children's initial reactions to the baby sibling are an important predictor of later sibling relationship quality. For example, children's early interest and affection toward the newborn sibling predicted friendly sibling relations approximately a year later (Dunn & Kendrick, 1982), which was then related to less antagonism toward the younger siblings when they were 6 years old (Stillwell & Dunn, 1985). Also, children's early cooperation in the care of their 1-month-old infant sibling predicted more positive sibling engagement and less antagonism and rivalry toward the sibling 8 months after the birth (Song & Volling, 2015). Thus, identifying factors associated with individual differences in young children's interactions with their infant sibling shortly after birth takes on particular importance if we are to understand which children engage in antagonistic and potentially aggressive interactions later on.

Sibling interaction may serve as a social arena in which aggressive children can engage in disruptive conflict and further exacerbate aggressive behavior (Dirks et al., 2015). Patterson's (1986) sibling coercion model proposed that siblings train one another to act more aggressively by modeling and reinforcing disruptive behaviors. In fact, a longitudinal study found that having a sibling increased the odds of membership in a highly aggressive group of children between 17 and 42 months of age (Tremblay et al., 2004). Oh, Volling, and Gonzalez (2015) also found that 42% of firstborn children showed an escalating pattern of antagonistic behavior toward their infant sibling starting 4 months after the birth. Because conflict is common during sibling interactions in the toddler and preschool years, occurring approximately 6.3 times per hour (Perlman & Ross, 1997; Stewart, 1990), aggression-prone firstborn children have ample opportunity to engage in aggressive exchanges with their sibling.

Children's use of aggression in social interactions may limit the types of conflict resolution strategies used during sibling conflicts because aggressive overtures not only create a negative affective environment but can also result in the sibling's passive withdrawal from social interactions, creating a destructive rather than a constructive atmosphere for sibling conflict (Howe, Rinaldi, Jennings, & Petrakos, 2002). Destructive sibling conflict involving physical aggression and intense negative affect at 5 years predicted boys' externalizing behaviors at

age 6 (Garcia et al., 2000) and increasing antisocial behavior toward siblings from ages 3 to 6 positively predicted antisocial behaviors toward unfamiliar peers at age 6 (Ensor, Marks, Jacobs, & Hughes, 2010). These findings underscore the potential for escalating, reciprocal influences between children's aggression and sibling conflict over time, yet there is a lack of research examining longitudinal, bidirectional influences between children's aggression and sibling antagonism in the 1st years of the sibling relationship. Links between aggression and sibling interaction may be weak at first but become stronger over the course of the year as children become more aggressive over time while participating in increasingly antagonistic interactions with their sibling, particularly as the infant sibling matures and becomes a more active social partner who can also contribute to antagonistic sibling interaction.

*Children's Aggression, Theory of Mind, and Sibling Relations*

Children's aggression is also closely linked to social-cognitive abilities. The social information-processing model (Crick & Dodge, 1994; Lemerise & Arsenio, 2000) stipulates that social-cognitive and emotional processes contribute to children's social competence in a reciprocal manner. In the case of children's aggression, an individual's emotional characteristics (e.g., negative emotionality) are intertwined with cognitive processes (e.g., ToM, perspective taking) to predict children's social adjustment (e.g., sibling relationship quality). The literature strongly supports a social information-processing model when examining links between children's aggression and ToM. Cross-sectional studies have found that disruptive behaviors (e.g., aggression) were associated with delays in affective perspective taking (Minde, 1992) and false-belief performance in preschoolers (Lane et al., 2013). Wellman et al. (2011) also found that false-belief understanding at 5 years was negatively predicted by children's aggression at age 3. These findings suggest that children's aggressive tendencies in social situations, such as sibling interactions, may serve as an obstacle for attending to and learning about others' minds. Aggressive children may be deprived of opportunities to learn about other's minds in both peer and family contexts because they are more likely to be rejected from social situations (McElwain, Olson, & Volling, 2002; Wood, Cowan, & Baker, 2002). During the 1st months after the birth of a sibling, parents are also likely to

intervene and prohibit aggressive preschoolers from further interactions with their infant siblings (Dunn & Kendrick, 1982; Oh et al., 2015), reducing opportunities for these children to learn about siblings' minds. Indeed, Dunn and Kendrick (1982) found that when mothers talked to their children about the infant sibling as a person and underscored the infant's feelings and needs in the 1st weeks after the birth, children were more likely to show better emotion understanding in the 1st year.

Extant studies rarely use a cross-lagged, longitudinal design to examine associations between aggression and ToM development, which lends difficulties in confirming the direction of influence. Is it the case that aggressive children are less likely to develop ToM abilities or, alternatively, that children with poor ToM understanding engage in more aggression over time? Although there is some evidence suggesting a positive association between ToM and proactive aggression among older school-age children (e.g., Sutton, Smith, & Swettenham, 1999), deficits in developing social cognitive skills may interfere with young children's understanding of others' intention, desires, and beliefs, which, in turn, can result in inconsiderate and aggressive behaviors toward others (Choe, Lane, Grabell, & Olson, 2013; Dodge & Coie, 1987). Interactions with others, especially siblings, can provide a rich social environment for young children to learn about others' desires and beliefs (Hughes & Leekam, 2004), and demonstrate social understanding (Howe et al., 2002). For example, cooperation with an older sibling at 33 months predicted younger siblings' various sociocognitive abilities (e.g., ToM, emotion understanding) 7 months later (Dunn et al., 1991). Sibling conflict may provide a rich opportunity for children to be exposed to opposing ideas and to learn to argue for their position, such that children grasp how to negotiate, persuade, and reconcile differing points of view through sibling disputes (Herrera & Dunn, 1997; Katz, Kramer, & Gottman, 1992). Foote and Holmes-Lonergan (2003) found that preschool children who used more other-oriented arguments—arguments taking into account the interests and perspectives of others—during sibling conflict also had better false-belief understanding, concurrently. On the other hand, simply engaging in antagonistic sibling conflict charged with negative emotion without the use of other- or self-oriented arguments was negatively related to social-cognitive understanding. Because there is a lack of longitudinal studies on ToM development and early sibling interaction, the direction of influence between early sibling antagonism and ToM

cannot be determined. To examine if the relation between children's ToM development and sibling conflict is reciprocal or unidirectional, and if so, in which direction, it should be examined longitudinally over time, which we do in the current study.

Despite these intriguing associations, no study has examined aggression and ToM longitudinally in the year following the birth of a sibling. During this transition, aggressive children may be especially likely to develop poor ToM, and poor ToM may lead to increased inconsiderate and aggressive behavior toward others, particularly toward the infant sibling (Dodge & Coie, 1987). Hughes and Ensor (2005) found that 2-year-old children with advanced ToM were more likely to have an affectionate sibling relationship, whereas children with poor ToM development had sibling relationships marked by high levels of conflict. Also, Stewart and Marvin (1984) found a positive association between preschoolers' perspective-taking ability and caretaking behaviors toward their infant siblings. These findings suggest the possibility that when children are able to understand their siblings' thoughts and needs, they may interact more positively with their infant siblings. Therefore, it is essential to understand how children's aggression, sibling interaction, and ToM are interrelated in the 1st year after an infant sibling's birth.

In the current investigation, we tested a developmental cascade model integrating firstborn children's aggressive behavior, their ToM, and early antagonistic sibling interaction in the year following the birth of an infant sibling. Developmental cascade models take advantage of longitudinal designs over multiple time points and allow one to assess precedence and consequence between variables and transactional processes among the constructs over time (Masten & Cicchetti, 2010). For example, the link between aggression and sibling antagonism not only might be direct, but it may also be indirect through children's ToM—poor ToM impedes children from building caring sibling relationships. Directionality of effects can also be examined in developmental cascade models. One can test whether sibling conflict predicts firstborn children's ToM understanding, whether ToM understanding predicts sibling conflict, or whether the effects are bidirectional. Cascade models require repeated assessments across multiple domains, controlling for intraconstruct stability and concurrent correlations across domains to test the cascade effects (Masten & Cicchetti, 2010). Developmental cascade effects reflect the progressive relations among multiple domains of functioning over time (Masten &

Cicchetti, 2010). That is, change in one area of children's functioning (e.g., ToM) triggers a progression of consequences that can affect other areas of social adaptation (e.g., aggression and sibling antagonism) at later points in time. A developmental cascade model allowed us to test predictions from the sibling coercion model directly by examining whether relations between children's aggression and sibling antagonism were more strongly intertwined over time and whether increases in children's ToM understanding weakened associations between children's aggression and sibling antagonism.

### *Current Study*

In short, research suggests that aggression, sibling antagonism, and ToM are closely related, but no study has examined these relations in the year following the birth of an infant sibling, even though early aggressive behavior and ToM may be particularly important for the development of antagonistic sibling relationships in the 1st year. In the current study, we examined children's ToM and aggressive behavior before the sibling's birth (prenatal) to predict antagonism toward their infant sibling and subsequent ToM at 4 and 12 months after the birth. We used a developmental cascade framework to model the bidirectional relations among firstborn children's aggression, antagonism toward their infant sibling, and ToM across three time points (prenatal, 4, and 12 months). Because no prior study has examined the simultaneous, bidirectional relations among aggression, sibling antagonism, and ToM, the analyses were exploratory, although we did expect children's aggression before the birth would predict poor ToM development and more antagonism toward the sibling at 4 months after the birth while controlling for the stability of aggression over time. Poor ToM and higher sibling antagonism at 4 months were also expected to contribute to increased aggression at 12 months and reveal bidirectional relations over time to create a developmental cascading effect. Throughout the article, we refer to the firstborns as the children and the infants as the siblings.

## **Method**

### *Participants*

Participants were part of a longitudinal study designed to investigate changes in family dynamics and firstborn children's adjustment after the birth

of a second child. Initially, 241 families living in four counties of southeastern Michigan were recruited through obstetric clinics, local hospitals, child-care centers, pediatricians' offices, childbirth education classes, and through local printed media. Families had to meet the following criteria: mothers were pregnant with a second child, the biological father of the infant was resident, firstborn children were between 1 and 5 years of age at the time of the birth, and both children had no mental or physical developmental delays. The data were collected from November 2004 to June 2010. Parents were predominantly middle-class and European American (83.8% of mothers; 85.1% of fathers), with 16.2% of mothers and 14.9% of fathers representing other racial and ethnic minorities. Most parents had a bachelor's degree or higher (83.9% of mothers; 79.2% of fathers), and the majority of families (70.6%) earned \$60,000–\$99,999 per year. Roughly half (46%) of the firstborn children and half (55%) of the infant siblings were boys.

Because children's ages ranged widely from 10 months to 5 years old at the first prenatal time point, and ToM is highly age sensitive, we restricted the sample for analysis to the 208 firstborn children who were 18 months to 47 months old at the prenatal time point ( $M_{\text{age}}$  at prenatal = 29.74 months;  $M_{\text{age}}$  at 4 months = 35.36 months;  $M_{\text{age}}$  at 12 months = 43.49 months;  $SD = 7.69$  months; 117 girls) so that oldest children were no more than 4 years old (59 months) at 12 months. This age range was chosen because early signs of understanding others' mental states are apparent by 18 months (Meltzoff, 1995; Repacholi & Gopnik, 1997) and dramatic growth in ToM is salient during the preschool years, providing a range of individual difference in the pace at which children progress, with most children achieving advanced ToM understanding (e.g., false belief, hidden emotion) by age 5 (Wellman, 2014). Specific age breakdowns are as follow: at the prenatal time point, 53 children were between 18 and 23 months, 97 children were between 24 and 35 months, and 58 children were between 36 and 47 months.

Missing data were handled with full information maximum likelihood estimation in structural equation modeling (SEM), resulting in 208 families for analyses. Among the 208 families, missing data percentages for study variables ranged from 0% to 17% ( $M = 10\%$ ). The result of Little's (1988) chi-square test of MCAR (Missing Completely at Random),  $\chi^2(246) = 259.93$ ,  $p = .26$ , revealed that the data were missing completely at random. The 208 families did not differ significantly from the

recruited sample of 241 on most of the demographic information (i.e., family income, parents' race and ethnicity, age, years of marriage, or siblings' gender) except that mothers were more educated,  $\chi^2(2) = 8.43, p < .05$ .

### Procedures

The original longitudinal study included five time points based on the infant's age: prenatal (last trimester of the mother's pregnancy with the second child), 1, 4, 8, and 12 months. Observations, interviews, and questionnaires were used to assess children's adjustment and family functioning. Children's ToM was assessed at their siblings' ages of prenatal, 4 months, and 12 months during home visits. This allowed sufficient time not only for changes to take place between assessments but also maintained relatively equivalent lengths between assessments (i.e., 8 months). Mothers' and fathers' reports of children's aggression and antagonistic sibling interaction collected at the same time points were used in analyses to coincide with the timing of ToM assessments. We relied on parents' reports because it is often difficult to observe low-frequency events such as aggression and antagonistic interaction in short observation sessions.

### Measures

#### Aggression

Both mothers and fathers completed the aggression subscale of the Child Behavior Checklist (CBCL 1½-5; Achenbach & Rescorla, 2000) at each time point. The CBCL is a widely used measure for identifying children's problem behaviors. Parents rated how well each of 19 items (e.g., hits others, demands must be met immediately;  $\alpha_s = .86-.89$ ) characterized their firstborn child's aggression using a 3-point scale (0 = *not true*; 1 = *somewhat true*; 2 = *very true*). Given their high intercorrelations ( $r_s = .37-.48, p_s < .001$ ), items were summed and mothers' and fathers' reports were averaged to create a single score at each time point. Changes in aggression from prenatal ( $M = 8.63$ ) to 4 months, ( $M = 9.01$ ),  $t(179) = -1.55, p = .12$ , and from 4 months to 12 months ( $M = 8.75$ ),  $t(169) = .62, p = .53$ , were not significant. The CBCL measure of aggression references an overall disposition to engage in aggressive behavior, which may be related to, but distinct from, aggressive acts directed specifically toward siblings, which we assessed with a separate sibling antagonism measure.

#### Sibling Antagonism

Both mothers and fathers completed the conflict scale of the Sibling Relationships in Early Childhood Questionnaire (Volling & Elins, 1998) to assess children's antagonistic behaviors directed toward their infant sibling, including teasing, bossing, and being physically aggressive toward the baby. Five items ( $\alpha_s = .72-.79$ ) were rated on a 5-point Likert scale (1 = *almost never*; 3 = *sometimes*; 5 = *almost always*) to form a composite of sibling antagonism (e.g., is physically aggressive with baby, teases or annoys baby). Due to significant correlations between mothers' and fathers' reports at each time point ( $r_s = .41-.47, p_s < .001$ ), scores were averaged across parents. There was a significant increase in sibling antagonism from 4 months ( $M = 1.64$ ) to 12 months ( $M = 2.40$ ),  $t(167) = -16.67, p < .05$ .

#### Theory of Mind

Children's social cognition was assessed using six ToM tasks (with two false belief tasks) that most children pass in sequential order during the course of early childhood (Wellman & Liu, 2004). Children were shown vignettes using drawings and figures, and asked questions to ascertain their understanding of others' desires, knowledge, beliefs, and emotion. In the not-own desire task, children judged whether two persons (the child vs. someone else) could have different desires about the same objects. During the not-own belief task, children judged whether people (the child vs. someone else) could have different beliefs about the same object, when children were unaware of which belief was true. In the knowledge access task, children saw the contents of a nondescript box and judged whether another person, who had not seen inside the box, would know the box's contents. In the explicit false belief task, children judged where someone would search for a missing object given the person's mistaken belief about the object's location, and in the contents false belief task, children judged whether someone would hold a true or false belief about the contents of a distinctive container when children knew that it contained something unexpected. Finally, the hidden emotion task examined whether children understood that a person could feel one thing but display a different emotion. A total score summed the number of the tasks for which children provided the correct answer. These sequential ToM tasks have been widely used across different countries (e.g., U.S. and China) and subpopulations (e.g., typically developing children, children with

deafness) to capture variations in the progression of children's ToM development (Peterson, Wellman, & Slaughter, 2012).

ToM measures are highly age sensitive, which creates a challenge in the longitudinal assessment of ToM using the same measure, thus some studies have used different age-appropriate ToM measures at different time points (e.g., Adrián, Clemente, & Villanueva, 2007; Fink, Begeer, Hunt, & de Rosnay, 2014). As such, the current study calculated ToM scores while taking into account the age range of children at each time point, allowing us to use the same sorts of tasks across different time points while reducing the positive skewness in ToM scores at the earlier time points. The first three tasks—*not-own desire*, *not-own belief*, and *knowledge access*—were used at the prenatal and 4-month time points when 75% of children (prenatal) and over 50% (4 months) of children were under age 3; thus, most children were still too young to pass explicit false belief and hidden emotion tasks (Wellman & Liu, 2004). ToM composites at prenatal and 4 months ranged from 0 to 3 tasks passed. At 12 months, 80% of children were between 36 months and 59 months; we used all six ToM tasks, including the false belief and hidden emotion tasks, so the ToM composite ranged from 0 to 6.

#### *Verbal IQ*

Children's verbal IQ was measured using the receptive vocabulary subscale of the Wechsler Preschool and Primary Scale of Intelligence, 3rd ed. (WPPSI-III; Wechsler, 2002), which is designed for children ages between 2 years 6 months and 7 years 7 months. Verbal IQ measured at 12 months (when all participating children were within this age range) was used as a covariate for ToM at all three time points in analyses.

#### *Data Analysis Plan*

Multiple path models using SEM examined the different paths between aggression and ToM at prenatal, 4, and 12 months, and sibling antagonism at 4 and 12 months (see Figure 1). A series of nested models were conducted to test whether a cascade model fit the data better than simpler longitudinal models without diagonal (i.e., cross-lag) paths across variables and time. All subsequent models contained paths included in the previous model. Model 1 was a stability model, which included stability paths (autoregressive paths) between repeated measures (e.g., aggression at pre-

natal time point to aggression at 4 months). This model only assumes within-variable stability over time but no relations across variables, either concurrently or longitudinally. In Model 2, a covariance model, correlation estimates were added within each time point (e.g., ToM at 4 months with sibling antagonism at 4 months). This model assumes within-variable stability over time, and also potential relations among variables, but only concurrently. Model 3 was a cascade model, which included diagonal paths between constructs at adjacent time points (e.g., aggression at prenatal time point to ToM at 4 months). This model assumes within-variable stability and potential relations among variables both concurrently and longitudinally between adjacent time points. Model fit was assessed with the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). CFI > 0.95 indicates good fit and RMSEA between 0.06 and 0.08 with upper bounds not exceeding 0.10 indicates an adequate model fit (Hu & Bentler, 1999). The chi-square test of significance is reported but not used as a measure of model fit in the current study, because it has been shown to be highly sensitive to sample size (Kline, 2005). AMOS version 22 was used for testing all models (Arbuckle, 2013). As follow-up analyses, indirect effects within the final model were tested for statistical significance.

## **Results**

### *Preliminary Analyses*

Means, standard deviations, and correlations among the focal variables are presented in Table 1. Significant positive correlations across time points were found for aggression, sibling antagonism, and ToM, indicating intraindividual stability over time. Aggression at all time points was positively correlated with sibling antagonism at 4 and 12 months. The concurrent correlations between the two were  $r = .27$  at 4 months and  $r = .54$  at 12 months, respectively. Among demographic variables, children's gender, family income, and type of child care were not related with any of the focal variables. Child age ( $r = .56-.65$ ,  $ps < .001$ ) and verbal IQ ( $r = .34-.38$ ,  $ps < .001$ ) were positively correlated with ToM at all three time points, and mothers' education was correlated with ToM at two time points ( $r = .11$  at prenatal and  $r = .14$  at 12 month,  $ps < .05$ ). These were included as covariates for ToM in the main analyses but are not shown in the figures for ease of presentation.

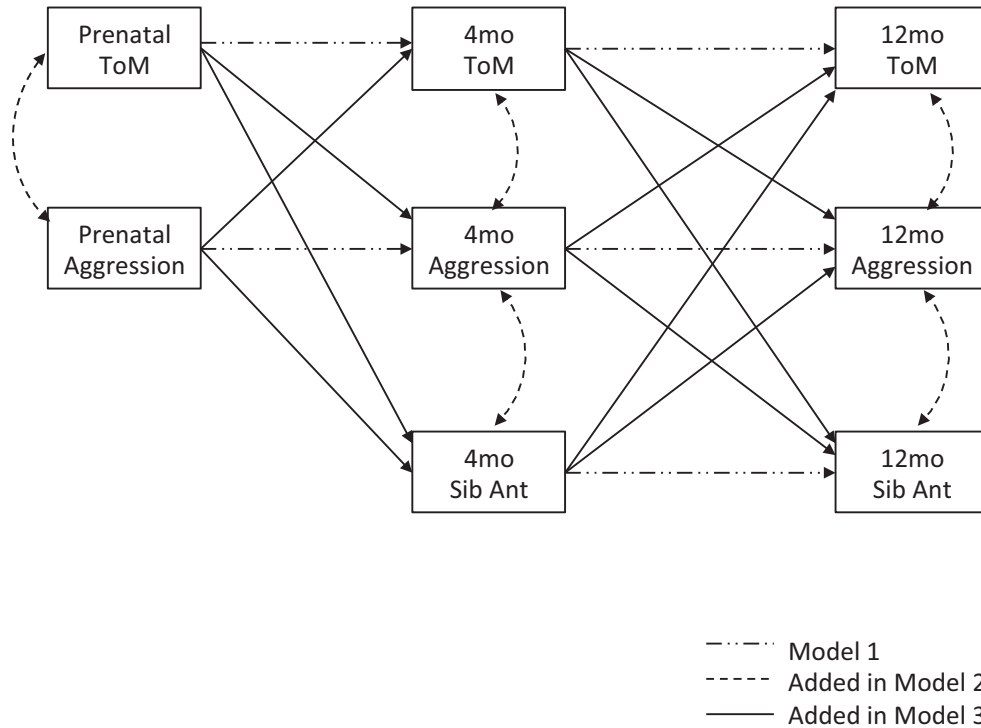


Figure 1. Hypothesized models of associations among theory of mind, aggression, and sibling antagonism. Model 1 (stability) only assumes individual stabilities of the variables. Model 2 (covariance) assumes individual stabilities and concurrent correlations among the variables within each time point. Model 3 (cascade) assumes stabilities, concurrent correlations, and developmental links across domains over time.

Note. Sib Ant = Sibling Antagonism.

Table 1  
Descriptive Statistics and Correlations for Aggression, Theory of Mind (ToM), and Sibling Antagonism

Variable	1	2	3	4	5	6	7	8
1. Aggression (P)	—							
2. ToM (P)	.004	—						
3. Aggression (4)	.72**	.02	—					
4. ToM (4)	-.06	.42**	-.05	—				
5. Sibling antagonism (4)	.28**	.07	.27**	.03	—			
6. Aggression (12)	.67**	-.05	.76**	-.10	.27**	—		
7. ToM (12)	.05	.53**	.06	.49**	.10	.04	—	
8. Sibling antagonism (12)	.34**	-.12	.38**	-.15	.36**	.54**	-.04	—
M	8.63	0.93	9.01	1.31	1.64	8.75	2.46	2.40
SD	4.54	0.93	4.71	0.97	0.50	4.98	1.44	0.53

Note. P = prenatal; 4 = 4 months time point; 12 = 12 months time point.  
\*\**p* < .01.

*Nested Model Comparisons*

Fit indices and model comparison tests are shown in Table 2 and the models are represented graphically in Figure 1. Model 1 (stability), which included stability paths within each construct over time, had poor fit to the data (CFI = 0.88, RMSEA = 0.10). Model 2 (stability + covariance), in which within time covariance estimates were

added, had poor fit to the data (CFI = 0.92, RMSEA = 0.09), even though fit significantly improved from Model 1,  $\Delta\chi^2(7) = 37.05, p < .001$ . Model 3 (cascade), including diagonal paths in addition to stability paths and covariance terms, had a good fit (CFI = 0.98, RMSEA = 0.06), which was significantly better than Model 2,  $\Delta\chi^2(10) = 46.23, p < .001$ . Therefore, Model 3 was chosen as the final model.

### The Cascade Model

The estimates based on the final model (Model 3) are shown in Figure 2. According to the autoregressive path coefficients, all three focal variables showed significant stability across time points except from prenatal ToM to 4-month ToM. As shown in Figure 2, results supported the significant longitudinal cross-lag relations from aggression to sibling antagonism at all time points, but the cross-lag path from 4-month sibling antagonism to 12-month aggression was not significant. Prenatal aggression also predicted poor ToM at 4 months, but 4-month aggression did not predict 12-month ToM. None of the cross-lag paths from ToM to aggression were significant, but poor ToM at 4 months did predict increased sibling antagonism at 12 months. Finally, even though sibling antagonism and aggression were positively correlated at 12 months, sibling antagonism at 4 months did not predict ToM or aggression at 12 months.

As a final step, the statistical significance of indirect paths in the final cascade model (Figure 2) were tested using Sobel's (1982) test, as recommended by MacKinnon, Lockwood, Hoffman, West, and Sheets (2002). Two indirect paths were statistically significant: (a) prenatal aggression predicted aggression at 4 months, which, in turn, predicted sibling antagonism at 12 months ( $z = 3.95, p < .001$ ); and (b) prenatal aggression predicted sibling antagonism at 4 months, which, in turn, predicted sibling antagonism at 12 months ( $z = 2.69, p < .01$ ). The indirect path from prenatal aggression to 12-month ToM ( $z = -1.77, p = .08$ ) and sibling antagonism ( $z = 1.47, p = .14$ ) through 4-month ToM did not reach conventional levels of statistical significance.

### Discussion

The present study examined longitudinal associations among children's aggression, ToM development, and antagonistic sibling interaction in the 1st

year of siblinghood using a developmental cascade model. The findings provide some support for cascading developmental effects of children's aggression, for both social-cognitive and sibling relational domains across the 1st year of the developing sibling relationship. Specifically, we found that children's aggression predicted antagonism toward their infant sibling over the 1st year of siblinghood, whereas sibling antagonism did not predict subsequent aggression. Higher levels of aggression, specifically at the prenatal time point, predicted poorer ToM at 4 months controlling for children's age, verbal IQ, and mother's education level. Poorer ToM did not predict increased aggression, although poorer ToM at 4 months did predict later sibling antagonism. Thus, the results revealed cascade effects from children's aggression before the birth of a sibling on antagonistic sibling interaction, as well as on ToM development at the end of the 1st year of siblinghood through some direct and indirect pathways. These findings help us understand the significance of children's aggression for their early social-cognitive development and adjustment to the transition to siblinghood.

Supporting the hypothesis that children's aggression before the birth of the sibling would predict more antagonism toward the sibling in the year following the birth, we found direct effects of aggression on later sibling antagonism. Aggression at both the prenatal and 4-month time points positively predicted higher levels of sibling antagonism at 4 and 12 months, respectively. Notably, these paths were significant while taking into account the stability of sibling antagonism, with aggression at 4 months continuing to predict 12-month sibling antagonism even after taking into account the variance explained by 4-month sibling antagonism. The association between aggression and sibling antagonism, however, was not bidirectional as high sibling antagonism at 4 months did not predict increased aggression at 12 months. Thus, there is no evidence supporting the longitudinal reciprocal influence between sibling interaction and children's

Table 2  
Model Fit Statistics and Comparisons

	<i>df</i>	$\chi^2$	CFI	RMSEA	90% CI	Model comparison	$\Delta\chi^2$	$\Delta df$	<i>p</i>
Model 1: Stability	39	121.40	0.88	0.10	0.08, 0.12				
Model 2: Covariate	32	84.35	0.92	0.09	0.07, 0.11	2 versus 1	37.05	7	< .001
Model 3: Cascade	22	38.12	0.98	0.06	0.03, 0.09	3 versus 2	46.23	10	< .001

Note CFI = comparative fit index; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for RMSEA.



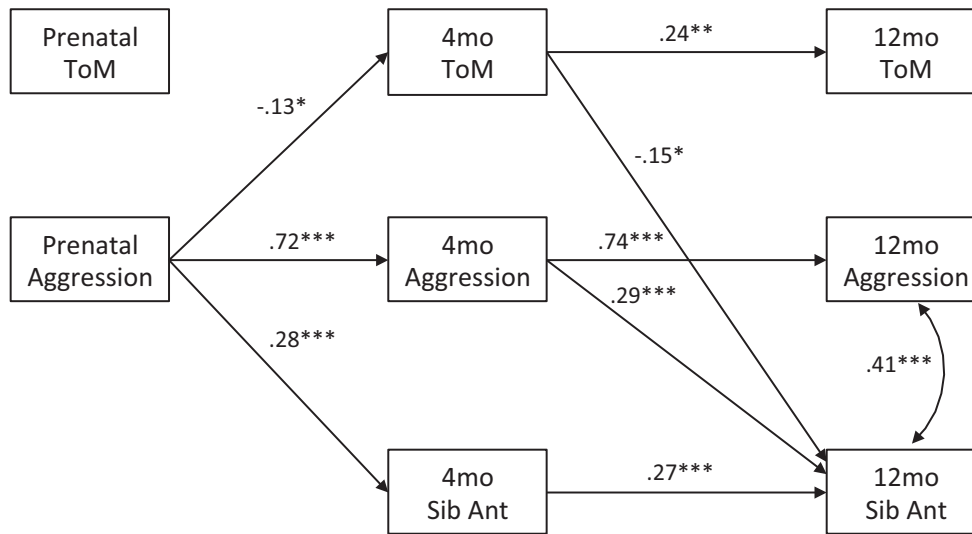


Figure 2. Standardized parameters for a cascade model (final Model 3).  $\chi^2(22, N = 208) = 38.12, p < .05$ , comparative fit index = 0.98, root mean square error of approximation = 0.06, 90% CI = 0.03, 0.09. Nonsignificant parameters remain in the model but are not displayed in the figure. Children's age, verbal IQ, and mothers' education were included as covariates.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Note. Sib Ant = Sibling Antagonism.

aggression that would be predicted from the sibling coercion model (Patterson, 1986), at least not in this 1st year of the developing sibling relationship. The unidirectional effect might be due to the short lag (i.e., 8 months) between time points or the fact that we only examined the children's behavior toward their infant sibling and not the infant's increasing abilities to reciprocate antagonistic interactions by the end of the 1st year. Knowing whether or not the infant sibling was also engaged in such antagonistic interactions as time progressed may be the missing link in understanding how early sibling interactions shape children's aggressive behavior.

Consistent with prior research, we found that children's aggression was relatively stable over time (Alink et al., 2006; Caspi & Moffitt, 1995; Olson, Lopez-Duran, Lunkenheimer, Chang, & Sameroff, 2011). Despite the stability in individual differences in children's aggression, aggression, as measured by the CBCL, did not evince mean changes over time. Sibling antagonism, on the other hand, not only revealed stable individual differences from 4 to 12 months but also mean increases over time, suggesting that children engage in more sibling antagonism as their infant sibling matures. Again, this may be a reflection of the increasing abilities of the younger sibling to engage in antagonistic sibling interaction as they get older and can reciprocate their older siblings' aggressive behavior (Dunn & Munn, 1986). These results are consistent with Stewart (1990), in which more than a half of the

participating children initially showed high levels of confrontation with their parents at 1 month, followed by a significant decline at 4 months, and an increase in confrontation with the infant sibling at 8 and 12 months.

The current study also found some support for a potential developmental pathway from aggression to sibling antagonism through poorer ToM. Specifically, aggressive children before the birth of a sibling performed poorer on ToM tasks at 4 months, which then predicted higher levels of antagonism toward the sibling at 12 months, although the indirect effect of aggression on sibling antagonism was not statistically significant. According to the social information-processing model, social cues between the child and others provide an ongoing source of information on how the social interaction is proceeding and allow the child to use these cues to adjust their social behavior accordingly (Lemerise & Arsenio, 2000). Children with poor perspective-taking ability or ToM are more likely to use less socially skilled (e.g., destructive, nonnegotiable) approaches to emotionally arousing social situations (Saarni, 1999). This may be one possible explanation for the path from poorer ToM at 4 months to higher sibling antagonism at 12 months. This is also consistent with earlier literature showing that children's social-cognitive abilities are closely related to sibling relationship quality (Hughes & Ensor, 2005). Other mechanisms besides delayed ToM may also be potential mediators between aggression and sib-

ling antagonism and might be worthwhile to examine in future studies. For instance, high emotional reactivity and poor self-regulation (Eisenberg et al., 2001) may play some role in explaining the link between aggression and sibling antagonism, as might the punitive and harsh parenting practices often be associated with childhood aggression (Pettit, Bates, & Dodge, 1997).

Our findings did not support reciprocal relations between ToM development and sibling antagonism at this young age. Children's enhanced ToM at 4 months predicted less sibling antagonism toward the infant at 12 months, but sibling antagonism at 4 months did not predict children's ToM at 12 months. Previous studies have found social-cognitive benefits of mental state conversation among siblings (Foote & Holmes-Lonerger, 2003; Katz et al., 1992), but 4-month-old infants in the current study were no doubt too young to provide the verbally rich language environment that facilitates children's mental state talk or other-oriented argument strategies. These relations between ToM and sibling interaction may be more prominent as the infant sibling becomes a more vocal and argumentative toddler and should be considered in future research. Still, the presence of an infant sibling could be beneficial for older siblings' ToM development, perhaps indirectly through mental conversation with the caregivers about the sibling's desires (Peterson, 2000). Recall that Dunn and Kendrick (1982) reported that mothers' discussions about the newborn baby as a person with distinct intentions and wants positively predicted children's verbal references to the infant's intentions and needs in the following year. Also, the association between sibling antagonism and ToM may eventually depend on the quality (e.g., constructive vs. destructive) of sibling conflict and how parents manage the conflict (Foote & Holmes-Lonerger, 2003; Slomkowski & Dunn, 1992). We would recommend that additional studies explicitly examine the role parents play in facilitating their children's ToM development in the year following the birth of an infant sibling.

Finally, we found partial support for our hypothesis regarding the relation between aggression and ToM development. More aggressive children at the prenatal time point had poorer ToM at 4 months, while taking into account the effect of ToM at the prenatal time point. Aggression at 4 months, however, did not predict ToM at 12 months directly, although the indirect effect of prenatal aggression on 12-month ToM through 4-month ToM was marginally significant. These results are consistent with

the social information-processing model that stresses the synergy between emotion and cognition underlying the progressive development of aggressive behaviors (Crick & Dodge, 1994). Lemerise and Arsenio (2000) noted that children with poor emotion regulation skills or high negativity were less likely to engage in effortful cognitive processes to access and evaluate various social cues (e.g., taking another person's perspective). Similarly, Dodge and Somberg (1987) suggested that a preemptive (i.e., "without thinking") process occurs more often in negatively charged emotional situations for aggressive children. Consistent with these empirical findings, our result adds to the notion that aggressive children's poor emotion regulation combined with poor ToM development may build an affective cognitive feedback structure that maintains or exacerbates aggression in social settings (Choe et al., 2013).

Our results also confirm that relations between aggression and ToM are not limited to false-belief understanding. Here, we found that children's aggression predicted poorer understanding of more fundamental and earlier developing ToM components (i.e., understanding diverse desires, diverse beliefs, and knowledge access). Presumably, aggressive children might be at dual risk because of dispositional characteristics (e.g., less careful, less observant) that are not conducive to developing ToM, as well as involvement in negative social interactions (e.g., having conflicts with parents and siblings, being excluded from sibling interaction by parents due to their aggressive behavior), which might lead to social rejection and more limited opportunities to engage in rich social experiences (Lane et al., 2013; Wellman et al., 2011).

#### *Strengths and Limitations*

One of the strengths of the current study was its longitudinal design to test a developmental cascade model that assessed the progression of children's aggression, ToM, and sibling antagonism as they developed over time in the 1st year after the sibling's birth. The findings help identify the processes by which children's aggression contributes to antagonistic sibling interactions early in life that may set the stage for further maladaptive social behaviors and provides insight into potential targets of intervention to prevent the escalation of aggression and sibling conflict over time. Effective intervention may want to target parents and teach them how best to respond to their children's aggressive overtures with a newborn infant, as well as positively

engage their children in the daily care of their infant sibling with a clear focus on conversing with children about the infant's own emotional states and needs. Future research is needed that examines explicitly how parents respond to children's antagonistic behaviors directed toward the infant in the early months to get a better sense of how these processes unfold over time. Another methodological strength was the assessment of ToM. Most studies have only used false belief tasks to measure children's social cognition. We utilized false belief tasks, as well as several other ToM tasks (Wellman & Liu, 2004), which allowed us to more sensitively capture growth in ToM among children across the broad age range of firstborn children included in this study.

Despite these strengths, there are also several limitations. Although we used multiple informants, including mother and father reports, to remedy single-reporter bias, parent reports of children's aggression and sibling antagonism are not free from biased interpretation. Direct observations of actual sibling interaction and children's aggression combined with parental reports would be useful in future investigations. Another limitation of the present study is that participating families were mostly White and middle-class, which may limit the generalizability of the findings to children from different socioeconomic and cultural backgrounds. Due to the unique characteristics of the current investigation following firstborn children's adjustment during the transition to siblinghood, the time points were established based on the age of the secondborn children, while the ages of the firstborn children varied considerably. As a result, we must acknowledge the possibility of a floor effect with the ToM measure at the prenatal time point when some of the children were quite young. The virtue of the ToM measure (Wellman & Liu, 2004) used in this study, however, is not that it fully captured what children were capable of at this young age but that it allowed the use of the same tasks across all time points so as to track children's ToM progress over time. It should be noted that the first task of the ToM measure (i.e., not-own desire task) has been used with children as young as 18 months of age (Repacholi & Gopnik, 1997). In an effort to reduce the potential skewness in the ToM measure, we also restricted the age range of children included in the analysis (18–47 months) and statistically controlled for children's age and verbal IQ. Finally, we used children's verbal IQ at the 12-month time point, when all children were within the normed age range of the WPPSI (i.e.,

2.5 years and above), as a statistical control for ToM at all three time points retrospectively. Future studies may want to control for concurrent verbal IQ measured at each time point when ToM was measured.

The arrival of a sibling dramatically expands social horizons for young firstborn children. How children socially and cognitively benefit from sibling interaction may depend on individual characteristics of children. The current study found that aggressive children before the birth of their sibling were at a greater risk for engaging in more antagonistic sibling interactions after the sibling's birth. These children were also more likely to experience poorer social-cognitive understanding, which, in turn, led to increased sibling antagonism. The findings underscore how social-cognitive and social-relational correlates of early aggression interact with each other during the 1st year of siblinghood. Uncovering these longitudinal relations across behavioral, cognitive, and social domains reminds us that there may be many different routes for preventive intervention for children undergoing the transition to siblinghood. Intervening in children's aggressive behavior may reduce their risk for consequent difficulties in ToM development and poorer sibling relationships. At the same time, facilitating children's ToM development despite aggressive behavioral characteristics may mitigate the link from aggression to sibling antagonism. One way to facilitate aggressive children's sociocognitive development might be through encouraging parents' use of mentalistic conversations with the child (Lagattuta & Wellman, 2002) and also through ToM training (Lecce, Bianco, Demicheli, & Cavallini, 2014), along with parents' modeling of prosocial behaviors to improve positive sibling relationship trajectories (Kramer, 2010).

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