Change in Maternal Perception of Sibling Negativity: Within- and Between-Family Influences

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Change in maternal report of sibling negativity was investigated in 313 sibling dyads from 171 families taking part in a longitudinal, general population survey in the United Kingdom. The inclusion of multiple dyads per family allowed for the emergence of 3 novel elements for sibling research: an examination of within-family similarity on sibling relationship quality, modeling within-family similarity as a function of the shared environment and the differentiation of family-wide and dyad-specific predictors. Moderate similarity on sibling negativity was found across different sibling dyads and similarity was higher in 2 versus lone-parent families. Maternal negativity, genetic relatedness, age of the oldest child in the dyad, and the interaction between lone-parent status and maternal differential treatment were found to predict change in sibling negativity.

Keywords: sibling relationships, lone parents, differential parenting, ecological models, multilevel modeling

The goal of this study is to demonstrate a novel design and method for the examination of sibling relationship quality. Previous research in this area has employed designs in which only one sibling dyad per family has been included in the analysis. In the present study a multilevel design is implemented in which multiple dyads per family are examined. This design allows us to distinguish between processes that occur within and between families to affect sibling relationship quality. The advantages of such an approach are examined in this paper. We use longitudinal data from the Avon Brothers and Sisters Study (ABSS) to illustrate the design and analytic method. In the ABSS relationship quality was investigated at Time 1 and at Time 2 (two years later), in up to three sibling dyads per family. One of the limitations of the present report is that only mono-agent data are available. Consequently, the focus of the present study is an illustration of the types of processes that can be captured by a multilevel approach, but such results will need to be replicated using multiinformant, multimethod data.

Bronfenbrenner (1977) raised the importance of conceptualizing development within a multilevel framework. He argued that children are influenced both directly and indirectly by environmental influences at different levels of their social context. A second perspective that influenced the design and hypotheses of this study comes from twin and sibling designs in which similarities between siblings in the same family are examined. When multiple children per family are included in the design it allows for the partitioning of variance into within- and between-family variance. From this three novel elements for research on sibling relationship quality emerge: examining within-family similarity on sibling relationship quality, modeling within-family similarity as a function of the environment shared by all sibling dyads and differentiating between family-wide and dyad-specific processes as predictors of sibling relationship quality.

Sibling negativity is the aspect of the sibling relationship that is the focus of this study. Associations have been found...
between high levels of sibling negativity and concurrent as well as subsequent increases in internalizing and externalizing behavior problems in children (Garcia, Shaw, Winslow, & Yaggi, 2000; Hetherington & Clingempeel, 1992; Kim, Hetherington, & Reiss, 1999; Stocker, Burwell, & Briggs, 2002; Yeh & Lempers, 2004) as well as negativity in other relationships such as the marital and parent–child relationships (Brody, 1998; Dunn et al., 1999; Jenkins, 1992; Patterson, 1986; Stocker & Youngblade, 1999). Given that sibling negativity is associated with other problems in families, it is important to attempt to identify the factors that exacerbate it.

Within-Family Similarity on Sibling Negativity

Are sibling dyads within a family more similar to one another than dyads from other families? If sibling dyads are found to be very similar to one another (and genetic effects have been controlled) then it may be that a characteristic of their shared lives has affected them similarly. Living in a lone-parent home, through resource limitations, may increase the family average for negativity shown between siblings. If further, all children react to this resource limitation in the same way, then the similarity of relationships across dyads will increase. If on the other hand sibling dyads are very dissimilar to one another then such dissimilarity is likely to be explained by a) experiences that are unique to individual dyads (dyad-specific characteristics such as the gender composition of the pair) or b) characteristics of dyads that influence the way that the dyad responds to the shared family characteristic (e.g., only all girl dyads show high negativity in lone-parent families). Thus in order to understand the different ways in which environments affect sibling relationships our first step was to examine the degree of similarity between sibling dyads within a family. Although genetic influences were not examined in the present study such influences may be responsible for the patterns described above. This is considered in the Discussion.

Shared Family or Dyad-Specific Predictors of Sibling Negativity?

In a multilevel design predictors can be assessed at the family level (the same score is shared by all sibling dyads) and the dyad-specific level (scores for dyads within the family differ from one another). It is possible to examine the drop in between- and within-family variance when predictors measured at the family and dyad-specific levels are entered into the model. For an example of the value of this consider the influence of maternal negativity on children. Maternal negativity has been found to be associated with sibling negativity (Brody, Stoneman, & McCoy, 1992; Furman & Lanthier, 2002; Stocker & Youngblade, 1999). No study has looked at more than one dyad per family. We do not know, therefore, whether children are responding to the ambient level of negativity in the family or the negativity that is directed specifically to the children in the dyad. Although this issue has not been examined directly in sibling research there are research findings that have tangential relevance. The dyad-specific process is well established: when mothers show more negativity to the members of a dyad, siblings show more negativity with one another. From work on marital conflict it is clear that children are also affected by witnessing negativity between people even if they are not the target (Davies et al., 2002). Given this it may be that ambient negativity in the household affects the sibling relationship rather than negativity directed specifically at the two children in the dyad. As the design of the present study included multiple dyads per family it was possible to distinguish between the family average of maternal negativity and the dyad-specific score for maternal negativity. We hypothesized that ambient maternal negativity would be a stronger predictor of sibling relationships than dyad-specific negativity.

Other predictors assessed at either the dyad or the family level were included. Deater-Deckard, Dunn and Lussier (2002), using cross sectional data (at Time 1) from the same sample as the present study, found that siblings in lone-mother families have relationships characterized by significantly higher levels of negativity as compared to siblings in two-parent families. This is a between-family variable and, as an independent effect, can only explain variance between families. Several dyad-specific factors were also examined in this study. First we examined genetic relatedness. Hetherington and colleagues (1999) as well as Deater-Deckard, Dunn and Lussier (2002) found that unrelated step-siblings had relationships characterized by significantly lower levels of negativity than full and half siblings, leading us to expect that unrelated siblings would show lower levels of sibling negativity than full siblings. Second, Dunn and Kendrick (1982) found that the quality of the sibling relationship was strongly influenced by characteristics of the older sibling at the time of the birth of the younger sibling. As increasing age is associated with decreasing negativity (Buhrmester, 1992), we expected that the older the oldest member of the dyad, the lower the sibling negativity would be. Third, the more differentially two siblings are treated by their parents, the more negative their sibling interactions have been found to be (see Brody, 1998 for review). This led us to hypothesize that maternal differential treatment would predict change in sibling negativity. Fourth, results for both age gap and gender composition of the dyad have been inconsistent leading us to include these variables in our analysis without specific hypotheses.

Modeling Within-Family Similarity as a Function of the Shared Environment

The third advantage of the multilevel design is that it allows us to examine within-family variability on sibling relationships as a function of characteristics of the environment that are shared by all siblings. Stressful family environments have been found to be associated with higher levels of within-family variation on personality and behavior. For instance, Jenkins et al. (2003) found greater variation in maternal treatment of children in high stress (low SES, lone parent and highly conflicted) than low stress homes. In another study Jenkins and colleagues found that
high marital conflict increased within-family differences in children’s externalising behavior over time (Jenkins et al., 2005). Thus characteristics of the family environment to which all siblings are exposed, when negative, may exacerbate within-family differences. In the present study we hypothesized that within-family variance on sibling dyad negativity would increase over time in lone-parent homes. If such a pattern is evident we can ask what the characteristics of dyads are that lead to higher levels of negativity in one dyad than another in the presence of a shared stressor. Differential susceptibility to the negative impact of contextual influences has often been described (Pettit, Bates, Dodge, Meece, 1999; Masten & Coatsworth, 1998). This issue has not been investigated for sibling dyads within families. Although lone-parent status has been found to be associated with higher levels of sibling negativity (Deater-Deckard et al., 2002), we thought it possible that decreased resources only lead to sibling negativity when children see these resources as being very differentially applied. As Jenkins et al. (2003) found that differential parental negativity toward siblings was higher in lone-parent than two parent homes we hypothesized that lone-parent status would be associated with sibling negativity when differential treatment was high.

Method

Sample Description and Procedures

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a longitudinal, prospective study of women, their partners, and an index child. The study design included all pregnant women living in the health district of Avon, England (Golding, 1996). It was estimated that 85% to 90% of the eligible population took part (N = 14, 000). The current study, the Avon Brothers and Sisters Study (ABSS), is a sub-study within ALSPAC that capitalized on the community nature of the ALSPAC sample and used it as a sampling frame to select a representative group of nonstep families (n = 50), lone-parent families (n = 50) and stepfamilies (n = 100, Dunn, Davies, O’Connor, & Sturgess, 2000). Families with two or more children were included in the sampling procedure because we were especially interested in within-family variation in behavior and family process. ABSS families did not differ from families of the same type in the larger community sample on maternal education, income, and child adjustment. Overall, 83% of eligible families who were approached agreed to participate in ABSS. In the ABSS sample, the average age at Time 1 of the youngest child (the ALSPAC target child) was 4.8 years (SD = .38) and the age range of the siblings was 6 to 17 years (M = 10.2 years, SD = 2.9). The sample was generally middle class, but included a range of socioeconomic levels. One previous report on sibling relationships has been published from the ABSS (Deater-Deckard et al., 2002). This report differed from the present study in two crucial ways: only cross-sectional relationships based on Time 1 data were reported and the multilevel structure of the data (with siblings nested within families) was not exploited.

Time 1 data collection included 50 intact or biological families (n = 113 children), 49 stepfather families (father not being biologically related to at least one child and the mother being biologically related to all children, n = 122 children), 45 complex/stepmother families (the mother not being biologically related to at least one child or both the mother and father not being biologically related to at least one child, n = 106 children), and 48 lone-parent families (n = 106 children). Two years later families were recontacted. Time 2 included 45 biological families (n = 101 children), 45 stepfather families (n = 115 children), 38 complex families (n = 103 children) and 43 lone-parent families (n = 94). Dropout from the study was significantly greater in families with lower socioeconomic status, r(439) = .30, p = .003, but participating and nonparticipating families did not differ on sibling negativity, family type or direct maternal negativity to children. Socioeconomic status was included as a covariate in analyses. Of those families that remained in the study at the two time points, 71 families had 3 participating children and 100 families had 2 participating children. Some of the effects to be investigated (e.g., dyad similarity) rely on variance partitioning and thus the presence of multiple sibling dyads; others such as fixed effects only hypothesized at one level do not require a multilevel design. Our analytic technique allowed us to separately estimate within- and between-family variances for those families with multiple sibling dyads, but yet to utilize the whole sample (and the increased power that this brings) to estimate the fixed effects for which the differentiation of within- and between-family variance was not crucial.

Twenty children did not reside full-time with the families described above. The criterion for being coded as “visiting” was that the child visited at least once per month. The average visits per month for this group were 6.7. Excluding these children would have meant the loss of 38 sibling dyads. Instead they were retained in the sample and visiting status was entered as a covariate.

Home visits were carried out. Mothers were interviewed alone using the measures described below.

Measures

Sibling negativity. At both Time 1 and Time 2, mothers were interviewed about the negativity within each sibling relationship using measures derived from the Colorado Maternal Interview on Sibling Relationships (Stocker, Dunn, & Plomin, 1990). Mothers were asked four questions about sibling negativity in the dyad. The first question related to intensity of disputes and was coded on a 5-point scale from no disputes to major disputes. Question 2 asked about the frequency of out-of-control behavior and was coded on a 5-point scale from never to frequently. Questions 3 and 4 related to the frequency of arguing and physical fighting and these were coded on a 6-point scale. Scores on these four questions were summed. Internal consistency of this measure at Time 1 was r = .68 and Time 2 was r = .65. Scores were normally distributed. Sibling Negativity Time 1 was centered for multilevel analyses. Children did not report on their negativity with their sibling until they were 8 years old. As target children were only 7 years old at Time 2 this meant that we had no child report data on the target children. For this reason our hypotheses could not be tested using child report data. It was, however, possible to examine patterns of agreement between mothers, oldest and middle children. Siblings completed the Sibling Areas of Disagreement (SAD; Hetherington & Clingempeel, 1992; described there as the Sibling Interaction Test), a 13-item questionnaire regarding the frequency and source of arguments between siblings. Each item is rated on a 7-point scale from “not at all in the last month” to “more than once per day.” Reliability ranged from r = .88 to r = .94 depending on respondent and dyad under consideration. When the relationship in question was that between the middle and older sibling, mother/older sibling correlations were significant at Time 1 and 2, respectively, r(45) = .33, p = .03 and r(47) = .33, p = .03. Similar results were obtained for mother and middle siblings as respondents, r(53) = .47, p = 005 and r(51) = .26, p = .07. Correlations
between older sibling and mother report with respect to the older/younger sibling dyad were lower and nonsignificant at both time points, \( r(43) = .15, p = .34 \) and \( r(50) = .14, p = .32 \). Correlations between middle sibling and mother report with respect to the middle/younger sibling dyad were significant at both time points, \( r(38) = .36, p = .03 \) and \( r(63) = .23, p = .05 \). Although these results demonstrate some agreement between mothers and their children about the quality of sibling relationships the small magnitude of the associations also suggests that mothers’ perspectives do not mimic children’s perspective, making it important in future research to examine predictors of each person’s report.

Maternal negativity Time 1: Family average, dyad-specific and differential maternal negativity. Maternal negativity toward the child was assessed at Time 1 using four scales: (a) a 4-item modified version of the Daily Routines Scale, (Hetherington & Clingempeel, 1992), assessed frequency of parent–child conflict on a 7-point scale, (b) the negative factor from the Parent-Child Relationship Scale (Hetherington & Clingempeel, 1992) included 11 items rated on a 7-point-scale, (c) a modified version of the Negative Sanctions Scale (Hetherington & Clingempeel, 1992) included 4 items rated on a 5-point-scale, and (d) an investigator-based interview measure of 4 questions, coded on 4–5-point-scales assessed the frequency and level of hostility (Dunn et al., 2000). Standardized scores from these four measures defined the Mother negativity composite and scores were centered within this sample for analysis. Internal consistency was \( \alpha = .76 \). We calculated the average score for family (called Family maternal negativity) and each dyad’s deviation from the average (called dyad-specific maternal negativity). The absolute difference between children in the dyad captures maternal differential negativity and this was centered for multilevel analyses.

Lone-parent status. The fixed effect term was coded 1 for lone parent with two parent 0 as the reference category.

Genetic relatedness between siblings in a dyad. Dummy codes were created for unrelated siblings and half siblings, with full siblings as the reference category.

Age of child: Age gap, oldest child age in dyad. Children’s age was obtained from mothers. Two age variables were constructed based on Time 1 data: the absolute difference between children in the dyad (age gap) and the age of the oldest child in the dyad (oldest child age). These were centered for multilevel analyses.

Gender composition of the dyad. Gender of each child was obtained from the mother and each dyad was coded as girl only, boy only or mixed. Mixed was the reference category.

Covariates. Visiting dyad (see sample description) was coded 1 if one child in the dyad did not live full time with the family and 0 if both members of the dyad lived with the family full time. Occupational status was assessed using the Registrar General’s classification of occupational status (OPCS, 1980). There are six categories of occupation from professional (1) to unskilled (6). The occupation of both parents was coded and the highest code for the family was used in the analysis. Families that were either stepfather or complex were coded as 1.

Results

Missing Data

The range of data points missing on single variables across models was between 0% to 23%. In order not to introduce bias into the sample through listwise deletion an imputation technique was used. Missing values were replaced through a process called multilevel multivariate mean value imputation. In the imputation model, the multilevel joint distribution of all the variables in the model is estimated. Thus the explanatory variables of the scientific model become multivariate response variables in the imputation model. The data in the imputation model are not balanced as some individuals will have missing data on some of the response variables. An estimation technique is required that can fit a multilevel multivariate response model that includes missing data. MCMC was used (Browne, 2003). This model includes all missing data values as parameters to be estimated. Where an individual has missing observations, a mean and variance for the distribution of each missing observation, based on the overall multilevel covariance structure of the variables and the nonmissing values present for the individual, were estimated. The mean of the distribution for each missing value was used as the imputed value in the scientific model.

Analysis Description and Plan

The response variable is Time 2 sibling negativity. Time 1 scores on sibling negativity were entered into the regression equation prior to any other predictor variables. Assuming stability on sibling negativity between Time 1 and Time 2 predictors can be interpreted as follows. At Time 2 some sibling dyads show greater negativity than expected based on their Time 1 scores while some show less. Predictors explain the relative increase or decrease in the scores of sibling dyads. We refer to the response variable as change in sibling negativity.

The different multilevel processes elucidated in the introduction were examined in a series of multilevel models of increasing complexity using the multilevel modeling program, Mlwin, version 1.10.0006 (Rasbash et al., 2000). The presence of multiple dyads per family required the use of a technique that could handle nested data. In multilevel models variance is partitioned into levels corresponding to the nested structure of the dataset, in this case between and within-family variance (displayed in the bottom half of Table 2). The within-family variance estimate represents the extent to which dyads within the family differ from one another on sibling negativity at Time 2, with higher values indicating more dissimilarity between sibling dyads. The between-family variance estimate indicates the extent to which families differ from one another on the family mean for sibling negativity. Results for shared and dyad-specific predictors (fixed effects) can be found in the top half of Table 2. These estimates and standard errors are interpreted as in a regression model. An estimate that is approximately twice the size of its standard error is significant \( p < .05 \). As predictors are entered into the model the between- and within-family variance estimates drop, depending on whether the predictor explains variance within or between families. The models presented mirror the processes described in the introduction and follow the same order. Multilevel models are run sequentially. Each model is compared with the previous model, using change in the loglikelihood (see bottom of Table 2) to determine whether the addition of the new parameter(s) improved the fit of the model. Parameters that are significant at \( p < .05 \) are bolded. Table 1 gives...
descriptive statistics for the variables used in the model and Table 2 shows results of multilevel analysis.

**Multilevel Analysis**

In order to control for previous levels of sibling negativity, Sibling Negativity Time 2 was regressed on Sibling Negativity Time 1 (not tabled). Relative stability in negativity was evident ($B = .49, SE .05$). Outside of the multilevel model we also investigated absolute change on sibling negativity from Time 1 to Time 2 using paired t test. The level of sibling negativity was found to decrease significantly between Time 1 and Time 2, $t(312) = 5.7, p < .001$. Putting these two findings together we conclude that siblings, to a moderate degree, maintain their rank order across time and that the mean level of negativity drops with age. For models that follow (Model 1 through 5) all predictor variables can be interpreted as predicting a change in sibling relationships. As the general trend is for decreasing negativity, parameters with positive coefficients predict higher than expected (on the basis of Time 1 scores) levels of negativity.

Within-family similarity on sibling negativity. For families with multiple sibling dyads two variances were derived: within- and between-family variance estimates. For families with one sibling dyad, only one variance was derived. These separate variance estimates are shown in Model 1. Intraclass correlation gives an indication of the degree of similarity shown by two dyads within the family when compared to two randomly chosen dyads. This is calculated as the between-family variance divided by the total variance (within + between) and was calculated for families with multiple siblings only. This yielded an ICC of .52 ($5.18/4.79 = 5.18$), suggesting a moderate degree of similarity on the negativity shown in sibling relationships in families with multiple dyads.

<table>
<thead>
<tr>
<th>Predictor and variance estimate</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.98</td>
<td>5.95</td>
<td>6.12</td>
<td>6.04</td>
<td>6.01</td>
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<tr>
<td>Sibling negativity, T1</td>
<td>.49</td>
<td>.42</td>
<td>.32</td>
<td>.33</td>
<td>.32</td>
</tr>
<tr>
<td>Family average maternal negativity</td>
<td>1.17</td>
<td>.40</td>
<td>1.03</td>
<td>.39</td>
<td>.95</td>
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<tr>
<td>Dyad-specific maternal negativity</td>
<td>-.75</td>
<td>.58</td>
<td>-.89</td>
<td>-.55</td>
<td>-.52</td>
</tr>
<tr>
<td>Lone parent</td>
<td>.13</td>
<td>.51</td>
<td>.90</td>
<td>.52</td>
<td>.17</td>
</tr>
<tr>
<td>Unrelated siblings</td>
<td>-.86</td>
<td>.63</td>
<td>-.73</td>
<td>.58</td>
<td>-.69</td>
</tr>
<tr>
<td>Half siblings</td>
<td>1.06</td>
<td>.40</td>
<td>-.91</td>
<td>.39</td>
<td>.89</td>
</tr>
<tr>
<td>Age of oldest</td>
<td>-.27</td>
<td>.08</td>
<td>-.32</td>
<td>.07</td>
<td>-.33</td>
</tr>
<tr>
<td>Age gap</td>
<td>.05</td>
<td>.08</td>
<td>.07</td>
<td>.07</td>
<td>.07</td>
</tr>
<tr>
<td>Differential maternal negativity</td>
<td>.46</td>
<td>.28</td>
<td>.40</td>
<td>.27</td>
<td>.26</td>
</tr>
<tr>
<td>Lone Parent × Differential Maternal Negativity</td>
<td>2.07</td>
<td>1.02</td>
<td>2.07</td>
<td>1.02</td>
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</table>

Variance estimate

<table>
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<tr>
<th>predictor and variance estimate</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple dyad: Between family</td>
<td>5.18</td>
<td>4.73</td>
<td>4.70</td>
<td>3.7</td>
<td>.87</td>
</tr>
<tr>
<td>Multiple dyad: Within family</td>
<td>4.79</td>
<td>4.80</td>
<td>4.20</td>
<td>.50</td>
<td></td>
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<tr>
<td>Single dyad families</td>
<td>10.04</td>
<td>9.56</td>
<td>9.00</td>
<td>1.27</td>
<td></td>
</tr>
<tr>
<td>Lone parent, multiple dyad between</td>
<td>3.09</td>
<td>3.67</td>
<td>2.41</td>
<td>3.10</td>
<td></td>
</tr>
<tr>
<td>Two parent, multiple dyad between</td>
<td>3.68</td>
<td>.86</td>
<td>3.60</td>
<td>.85</td>
<td></td>
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<tr>
<td>Lone parent, multiple dyad within</td>
<td>11.27</td>
<td>4.0</td>
<td>9.95</td>
<td>3.52</td>
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<tr>
<td>Two parent, multiple dyad within</td>
<td>3.34</td>
<td>.42</td>
<td>3.38</td>
<td>.43</td>
<td></td>
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<tr>
<td>−2 × log like</td>
<td>1555.16</td>
<td>1545.81</td>
<td>1504.95</td>
<td>1491.48</td>
<td>1487.68</td>
</tr>
<tr>
<td>Change in model fit ($\chi^2$) from prior model to present d/s</td>
<td>9.35**</td>
<td>40.86**</td>
<td>13.47**</td>
<td>3.95*</td>
<td></td>
</tr>
</tbody>
</table>

Note. T1 = Time 1. Coefficients and their standard errors, significant at $p < .05$, appear in bold.

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

Table 1

**Descriptive Statistics: Sample Characteristics and Variables in the Study**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibling dyads in study</td>
<td>313</td>
<td>100</td>
</tr>
<tr>
<td>Full sibling dyads</td>
<td>163</td>
<td>52</td>
</tr>
<tr>
<td>Half sibling dyads</td>
<td>125</td>
<td>40</td>
</tr>
<tr>
<td>Unrelated sibling dyads</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>Boy-only dyad</td>
<td>95</td>
<td>30</td>
</tr>
<tr>
<td>Mixed dyad</td>
<td>163</td>
<td>52</td>
</tr>
<tr>
<td>Girl-only dyad</td>
<td>55</td>
<td>18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibling negativity T1</td>
<td>6.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Sibling negativity T2</td>
<td>5.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Age of oldest in dyad</td>
<td>8.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Age gap in dyad</td>
<td>4.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Differential maternal negativity</td>
<td>0.63</td>
<td>0.58</td>
</tr>
<tr>
<td>Direct maternal negativity: Average for dyad</td>
<td>0.28</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Note. T1 = Time 1; T2 = Time 2.
**Shared family or dyad-specific predictors of sibling negativity.** Average family and dyad specific negativity are confounded for single dyad families. In order to deal with this we created two separate parameters for average maternal negativity: one for multiple dyad families and one for single dyad families. For families with multiple sibling dyads the dyad-specific score was also entered into the model. Results showed that estimates for average maternal negativity when assessed separately for multiple dyad families and single dyad families were very similar (1.29, se. 60 for multiples; 1.08, se.52 for single-dyads). Further the estimate for the dyad-specific effect remained unchanged (−.74, SE = .58 vs. −.75, SE = .58) when the family averages for multiple and single-dyad families were entered as two separate parameters or when the two parameters were estimated as one parameter (family average across sample). To increase power and parsimony we just entered one parameter for family average across the sample. It is possible to see from Table 2 that the family average is a significant predictor of sibling negativity whereas the dyad-specific effect is not. This suggests that ambient maternal negativity is a stronger predictor of siblings’ negativity than dyad-specific maternal negativity.

In Model 3 we tested the hypothesis that lone parent status and the dyad-specific predictors of maternal differential treatment, genetic relatedness, age of oldest child and age gap would predict change in sibling negativity. Gender composition was substituted for genetic relatedness in a later separate analysis (see below). This was in order that we could make comparisons with the most appropriate reference category. Results showed that full siblings showed higher sibling negativity over time than half siblings, but were not found to be significantly different from unrelated siblings (See Table 2, Model 3). Unrelated and half siblings were not found to differ from one another. There was significantly less negativity when the oldest child in the dyad was more advanced in age (see Age of oldest). Neither lone parent status, maternal differential treatment, nor age difference in the dyad were significant predictors of sibling negativity. Within-family variance dropped by 12.5% in the multiple dyad families and total variance dropped by 6% in the single dyad families. Models were also run with the substitution of gender composition (reference category mixed gender dyads). This model showed that sibling dyads with girls only, but not dyads with boys only, showed higher negativity than mixed dyads (B = 1.06, SE .41).

**Modeling within-family similarity as a function of the shared environment.** In Model 4 we broke down the variance estimates further to examine whether sibling dyads in lone parent families were more varied in sibling negativity than sibling dyads in two-parent families. Again this analysis was only applicable to multiple dyad families. Within- and between-family variances were separately parameterised for lone versus intact families, adding two more terms to the equation. This significantly improved the fit of the model. It is possible to see that the within-family variance for multiple dyad, lone parent families is much larger than that for multiple dyad, two parent families. This results in a lower intraclass correlation among the sibling dyads in lone

**Discussion**

The novel element of this study was the inclusion of families with more than one sibling dyad. Past research in this area has, by virtue of including only one sibling dyad per family in the analysis, confounded dyad- and family level processes as well as within- and between-family variance. This design feature allowed us to examine dyad similarity within families, model within-family similarity as a function of the shared environment, differentiate between shared family and dyad-specific processes and examine the moderating influence of dyad-specific processes on shared family stressors. The findings illustrate the importance of conceptualizing the family as a multilevel structure.

Before reviewing the significance of individual results we consider the potential impact of single informant method-
ology on results. First, dyad similarity may have been inflated as a result of single-informant methodology. Mothers may be insensitive to the differences in relationship quality between sibling dyads such that they rate dyads as more similar than they are in actuality. Second, the between-family predictors of maternal negativity and lone parent may be markers for negative maternal mood. It may be mood that leads mothers to exaggerate the negativity in sibling relationships, creating the association between maternal negativity and sibling negativity. Although this is a possibility, the longitudinal design decreases the likelihood of such an interpretation as the measurement of predictor and outcome variables was separated by two years. Further, others, using observational methods, have found maternal negativity to be linked to sibling negativity (Brody, Stone-mann & McCoy, 1992). Third, the finding that ambient maternal negativity was a stronger predictor of sibling negativity than dyad-specific negativity may also be attributable to mothers being insensitive to differences in their own expression of negativity to different children. A final measurement issue should be considered. The internal consistency on maternal report of sibling dyad negativity was lower than is often found for child aggression (Achenbach, Howell, Quay, & Conners, 1991), although the two concepts are not dissimilar. It may be easier for mothers to rate their single children, rather than sibling dyads.

**Within-Family Similarity on Sibling Negativity**

In families with multiple sibling dyads a moderate level of similarity was found in the relationships of dyads. This suggests processes in families, shared by all siblings that affect how relationships develop. In the present study uncontrolled influences may also have been responsible for sibling similarity within families and in future studies it will be important to utilize designs in which genetic influences can be effectively estimated.

**Modeling Within-Family Similarity as a Function of the Shared Environment**

It is interesting to note that dyad similarity varied as a function of family stress. Sibling dyads were more varied in lone parent families than two parent families. This is an example of a shared family stressor being associated with increased within-family variation. This is theoretically interesting within the debate on why siblings are so different from one another once genetic effects have been controlled (Turkheimer & Waldron, 2000). Although one reason why siblings are different from one another relates to the differential experiences they have both inside and outside the family, that is, the nonshared environment (equivalent conceptually to the dyad-specific experiences examined here) another reason is that the same stress increases differences between siblings. Why is it that the experience of lone parenthood increases differences in sibling relationship quality? Lone parents have been found to show higher levels of stress and more negativity when parenting their children (Furman & Lanthier, 2002) and such parenting may feel stressful for children. If siblings feel attached to one another then they may move closer to support one another. On the other hand, preexisting antagonisms in the sibling relationship may be exacerbated when other aspects of the family dynamic is stressful.

Lone parent status was more strongly associated with change in sibling negativity when differential maternal treatment between two siblings was high. A plausible interpretation of this finding is that although there are fewer parenting resources in lone parent families this is most problematic for sibling interaction when children feel that the allocation of resources is unfair (Kowal & Kramer, 1997). Thus in response to the stress of being raised in a lone parent family, dyads become more differentiated from one another on sibling negativity. In part such negativity may be explained by siblings feeling that they are being disadvantaged. In the absence of such disadvantage lone parent status was not associated with higher levels of sibling negativity. This finding is significant for the debate on sibling differences. It shows that the shared environment does have a negative effect on children’s relationships, but it only does so when certain dyad-specific conditions pertain. If we extend this to the broader debate on sibling differences then a reason for sibling dissimilarity is not that the shared environment is unimportant (as is sometimes concluded) but rather that nonshared environmental influences interact with shared environmental stressors to affect outcomes.

**Predictors of Sibling Negativity: Family or Dyad Specific?**

Maternal negativity has been found in other studies to predict sibling negativity. The novel element of this study was the differentiation of ambient (family average) and dyad-specific negativity. The family average explained more of the variance in change in sibling negativity than the dyad-specific score. As previously discussed single informant data may have contributed to this result if mothers are insensitive to differences in their own negativity toward different children in the family. It will therefore be important to replicate this result using observational data. If this result is replicated with observational data, one possible explanation relates to the role of affect spillover in family dynamics. It has been argued that affect in families does not remain encapsulated in specific relationships, but rather spreads across different elements of the family so that multiple relationships are characterized by negative affective interchanges. For instance, anger and aggression in the marital relationship have been found to be associated with more negative parent–child relationships (Davies, Harold, Goake-Morey, & Cummings, 2002; Stocker & Youngblade, 1999) more negative sibling relationships (Brody, Stone-mann & McCoy, 1992; Dunn, 1992) and more aggressive child behavior. Affect contagion (Hatfield, Cacioppo, & Rapson, 1994) may operate such that watching mothers interact in a negative way with another dyad makes the uninvolved child feel more negative. Alternately, the child may carry their experience of their mothers’ negativity from
one sibling dyad to another. Margolin, Andrew and Richard (1996) have demonstrated such carry over effects using sequential analyses across marital, parental and sibling dyads.

Dyad-specific characteristics were found to explain 12.5% of the within-family variance in multiple dyad families. Greater genetic relatedness predicted higher levels of sibling negativity within families. Others have found that lower levels of genetic relatedness between members of a dyad, in both sibling and parent–child relationships, is associated with greater disengagement and consequently less negativity (Deater-Deckard, Dunn and Lusier, 2002; Hetherington et al., 1999). No significant difference was found in the present study between unrelated and full siblings although this is likely to be because we had insufficient power to detect the differences that others have detected with larger samples (Hetherington et al., 1999). The older in age the oldest child in the dyad, the lower the levels of sibling negativity. Characteristics of older children have been found in other studies to be important in influencing the quality of sibling interaction (Dunn & Kendrick, 1982). As children get older their feelings of resentment and competition with siblings lessen (Buhrmester, 1992). If older siblings generate less negativity, they may also elicit less from their younger siblings. These results suggest that older siblings have more power to influence the course of sibling relationships than younger siblings. Girl-only sibling dyads were found to show more negativity than mixed gender dyads, although the same difference was not seen for boy only dyads. As other studies have reported mixed results on this issue (Dunn, 1992) it is likely that important moderators have not been identified.

In summary, moderate similarity on sibling negativity was found across different dyads in the family. Similarity of sibling dyads was higher in two-parent families than in lone-parent families. Maternal negativity assessed at the family level, as well as full versus half sibling status and the age of the oldest child in the dyad, explained change in sibling negativity. Maternal differential treatment also predicted change in sibling negativity but only in lone-parent families. This study illustrates the value of the multilevel design for understanding sibling negativity. In future these techniques should be combined with the strength of multi-informant, multithread designs as it was not possible to examine the extent to which the present results were affected by single-informant measurement.

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