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For almost three decades, the association between paternal sensitivity and infant–father attachment security has been studied. The first wave of studies on the correlates of infant–father attachment showed a weak association between paternal sensitivity and infant–father attachment security ($r = .13, p < .001, k = 8, N = 546$). In the current paper, a meta-analysis of the association between paternal sensitivity and infant–father attachment based on all studies currently available is presented, and the change over time of the association between paternal sensitivity and infant–father attachment is investigated. Studies using an observational measure of paternal interactive behavior with the infant, and the Strange Situation Procedure to observe the attachment relationship were included. Paternal sensitivity is differentiated from paternal sensitivity combined with stimulation in the interaction with the infant. Higher levels of paternal sensitivity were associated with more infant–father attachment security ($r = .12, p < .001, k = 16, N = 1,355$). Fathers’ sensitive play combined with stimulation was not more strongly associated with attachment security than sensitive interactions without stimulation of play. Despite possible changes in paternal role patterns, we did not find stronger associations between paternal sensitivity and infant attachment in more recent years.

Keywords: father, sensitivity, stimulation, attachment, meta-analysis

Attachment security represents the child’s trust in his or her caregiver, and is evident from the child’s preferential desire for contact with the caregiver in times of stress and use of the caregiver as a “secure base” to explore the environment (Bowlby, 1969). Maternal sensitivity plays a crucial role in shaping the mother–infant attachment relationship. Sensitivity is defined as the ability to perceive and to interpret accurately the signals and communications im-
licit in the infant’s behavior, and given this understanding, to respond to them appropriately and promptly (Ainsworth, Blehar, Waters, & Wall, 1978). Examples of sensitivity include contingent vocalizations, encouragement of the child’s efforts, and soothing the infant in times of distress. The association between maternal sensitivity and the mother–infant attachment relationship is a frequently replicated finding, not only in correlational studies (see De Wolff & Van IJzendoorn, 1997, for a meta-analysis), but also in randomized experimental intervention studies. Interventions that most successfully manage to enhance the level of maternal sensitivity also create the largest increase in attachment security (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003), which suggests a causal relation between sensitivity and attachment.

At the core of attachment theory is the claim that infants not only become attached to their biological mother but also to other caregivers who interact regularly with them. Although biological mothers were the target of most studies on sensitivity and infant attachment, several studies focused on the role of paternal sensitivity in infant–father attachment. The first wave of studies on the correlates of infant–father attachment showed a weak association between paternal sensitivity and infant–father attachment security. Van IJzendoorn and De Wolff (1997) reported that the combined effect size across eight studies amounted to a correlation of .13, whereas the effect size for maternal sensitivity and infant–mother attachment was estimated to be $r = .24$ in a much larger set of 21 studies (De Wolff & Van IJzendoorn, 1997). More recent studies on fathers show mixed results, with some failing to find a significant relation between paternal sensitivity and attachment security (Braungart-Rieker, Garwood, Powers, & Wang, 2001; Volling, McElwain, Notaro, & Herrera, 2002), and others reporting a significant but modest association (Eiden, Edwards, & Leonard, 2002; Lucassen et al., 2010).

At least two reasons for the rather weak association between paternal sensitivity and attachment may be mentioned. First, fathers spend less time with their child compared to mothers, who are usually the primary caregiver. The link between their parenting behavior and the attachment relationship may be more tenuous than in the case of mothers. Research on infant attachment and sensitivity of highly involved fathers is scarce and equivocal (Cox, Owen, Henderson, & Margand, 1992; Lucassen et al., 2010). Second, fathers may interact with their infants in somewhat different ways compared to mothers. Traditionally, fathers have been described as focused on stimulating and exploratory play interactions with their children, with less emphasis on emotional support and warmth (Grossmann, Grossmann, Kindler, & Zimmermann, 2008). Mothers might relate to their infants with sensitive warmth, whereas fathers might choose sensitive stimulation as a way to promote feelings of security in their infants. Stimulation can be described as any activating interaction on the part of the parent directed toward the infant in order to promote his or her exploration or playful behavior (De Wolff & Van IJzendoorn, 1997).

Examining determinants of the attachment relationship with the infant is important, since several studies have shown positive correlates with a secure father–child attachment relationship. For example, children with a secure attachment relationship with their father have fewer behavior problems (Verschueren & Marcoen, 1999) and show higher levels of sociability (Lamb, Hwang, Frodi, & Frodi, 1982). In this paper, a meta-analysis of the association between paternal sensitivity and infant–father attachment is presented, elaborating on the meta-analysis conducted by Van IJzendoorn and De Wolff in 1997. Through cumulative meta-analysis (Borenstein, Hedges, Higgins, & Rothstein, 2009), we document the change in effect sizes across the past three decades of research. This cumulative meta-analysis is important for the field of father studies, as fathers seem to have become gradually more involved in positive engagement activities with their children over the last few decades, which might affect the relationship with their child (Pleck, 2010). In a cumulative meta-analysis, new research findings are added to what was previously known. Each time a new study is added, a separate meta-analysis is conducted (Muellerleile & Mullen, 2006). Typically, each new study reduces the confidence intervals around an increasingly precise estimate (Hanson & Broom, 2005). A cumulative meta-analysis has more statistical power, which is especially relevant to a set of studies in which small effect sizes are observed (Mulrow, 1994). Special attention in this analysis is given to the potentially different roles of paternal sensitivity and paternal sensitivity combined with stimulation. We expect that higher levels of paternal sensitive warmth, and in particular when co-occurring with sensitive stimulation, are associated with more infant–father attachment security.

**Method**

**Dataset**

For our meta-analysis, we systematically searched the databases PsycInfo, Social Sciences Citation Index, Educational Resources Information Center, and ProQuest Dissertations and Theses with the keywords father, fathering, paternal, sensitivity, responsivity, synchrony, warmth, parenting, and attachment in the title or abstract. We searched the online available integrative statements of the paper symposia organized at the biennial meetings of the Society for Research in Child Development (2009–2011). Furthermore, we used the search engine Google Scholar with the keywords father, sensitivity, and attachment to identify relevant studies. In addition to the electronic searches, we searched recently published books on attachment, fathering, or parenting with contributions from international experts on these topics (Cummings & Cummings, 2002; Grossmann et al., 2008; Lamb & Lewis, 2010; Parke, 2002). Infant–father attachment studies conducted before 1996 were derived from the first meta-analysis on this topic by Van IJzendoorn and De Wolff (1997). Lastly, the reference lists of the collected papers were searched for relevant studies. We finished the search in May, 2011.

We detected 1,613 studies with our search terms. Our search was restricted to studies using an observational mea-
sure of paternal interactive behavior with the infant, and the gold standard assessment of attachment security, the Strange Situation Procedure (SSP, Ainsworth et al., 1978). After examining the abstracts of all studies, 22 studies were relevant for our meta-analysis. Six studies presented data on (partly) overlapping samples. When samples of studies were overlapping, the papers that reported on the largest groups of participants were included in our meta-analysis. We found one dissertation abstract (ProQuest document ID: 2105027951) with measurements of sensitivity and attachment in “parents”, but it was unclear whether fathers were included in the study, and this graduate work was not available for purchase at the request of the author, thus we could not determine what type of measurements were used. Finally, we identified 16 pertinent effect sizes on 1,355 subjects, which are presented in Table 1.

Moderators

We coded the following study characteristics: year of publication, sample size, the age of the child at the time of assessment of attachment security (for the purpose of moderator analysis, age was split in two sets: younger than 16 months of age vs. 16 months and older), study design (concurrent vs. predictive), percentage of secure infant–father attachment relationships, and measurement of sensitivity (sensitivity or sensitivity combined with stimulation). The selection of these moderator variables was based on theoretical and empirical reasons. We focused on the child’s age as a moderator since the quality of the relationship between father and child may depend on the developmental phase of the child. Also, the meta-analysis of infant–mother dyads (De Wolff & Van IJzendoorn, 1997) showed that the age of the infants at the time of the attachment assessment was a significant moderator, with older infants showing stronger effect sizes. A concurrent study design may show stronger effect sizes than a predictive design because a possibly bidirectional association between sensitivity and attachment could contribute to the strength of the observed effects in a concurrent design. Also, the meta-analysis of De Wolff and Van IJzendoorn (1997) found that a shorter time interval between the sensitivity and attachment assessments showed stronger effect sizes. All of the included studies used either a predictive or a concurrent design; none of the studies used a combination of predictive and concurrent measurements. Lastly, as described in the introduction, we distinguished studies in which the traditional concept of sensitivity (warmth, emotional support, responsiveness) was observed from studies in which the quality of stimulating and exploratory play was additionally observed.

Data Analysis

The Comprehensive Meta-Analysis (CMA) program was used to transform the results of the individual studies into the common metric of Pearson’s product-moment correlation coefficients \( r \) and to combine weighted effect sizes (Borenstein et al., 2009). Heterogeneity across studies was assessed using the \( Q \)-statistic. Significance tests were performed through random effects models (Borenstein et al., 2009). We computed the 95% confidence interval around the mean effect size. \( Q \)-statistics and their \( p \) values were also computed to assess differences between combined effect sizes for specific subsets of study effect sizes grouped by moderators. Contrasts were only tested when at least two of the subsets consisted of at least four studies (Bakermans-Kranenburg et al., 2003). Again, random effects model tests were used. For continuous moderators, Fisher’s \( Z \)-scores were used in weighted least squares metaregression analyses. The “trim and fill” method was used to test the influence of possible adjustments of the sets of studies for publication bias (Duval & Tweedie, 2000a, 2000b). No outliers (standardized \( z \)-values smaller than –3.29 or larger than 3.29; Tabachnick & Fidell, 2001) were found for study effect sizes.

Results

Table 2 presents the combined effect size of the 16 studies as well as confidence intervals, homogeneity tests, and contrast tests. The combined effect size for the association between paternal sensitivity and infant–father attachment was \( r = .12 \) (95% CI .06, .17, \( k = 16, N = 1,355, p < .001 \)). The set of study outcomes was homogeneous, \( Q(15) = 12.80, p = .60 \). Using the trim and fill method (Duval & Tweedie, 2000a, 2000b), we did not find asymmetry in the funnel plot (precision plot, random effects), which suggested the absence of a potential publication bias.

Moderator analyses did not show significant contrasts for measurement of sensitivity, the age of the child at the time of assessment of attachment security, and study design (see Table 2). The metaregressions with the continuous moderators “year of publication,” “percentage secure,” “age of the child at the time of assessment of attachment,” and “sample size” did not show significant effects either (\( z = -0.25, p = .80, z = 0.89, p = .38, z = -1.44, p = .15, \) and \( z = 0.09, p = .93 \), respectively).

A cumulative meta-analysis confirmed the absence of an association between year of publication and effect size. In Figure 1 the development of the combined effect size across time is presented, and a trend toward stronger associations between paternal sensitivity and infant security did not appear to be present.

Discussion

In this meta-analysis, we showed that higher levels of paternal sensitivity were associated with more infant–father attachment security. The association between sensitivity and attachment security was reliable, but weak. Yet, this finding contributes to the field of father research in several ways. First, this meta-analysis included twice as many studies with more than twice as many infant–father dyads compared to the meta-analysis conducted by Van IJzendoorn and De Wolff in 1997. Thus, it provides an update of studies on paternal sensitivity and attachment. Second, we were able to examine whether a trend toward stronger associations between paternal sensitivity and infant attachment...
Table 1
**Infant–Father Attachment Studies: Descriptives and Effect Sizes**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>N</th>
<th>Measurement of sensitivity</th>
<th>Age observation sensitivity (months)</th>
<th>Design</th>
<th>Age Strange Situation Procedure (months)</th>
<th>Secure (%)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Belsky (1983)&quot;</td>
<td>51</td>
<td>Overall engagement, response, stimulation, care giving, positive affection (SS)</td>
<td>1, 3, 9</td>
<td>P</td>
<td>13</td>
<td>63</td>
<td>.11</td>
</tr>
<tr>
<td>&quot;Easterbrooks (1984)&quot;</td>
<td>75</td>
<td>Emotional supportiveness, quality of assistance (SS)</td>
<td>20.5</td>
<td>C</td>
<td>20.5</td>
<td>66</td>
<td>.00</td>
</tr>
<tr>
<td>&quot;Goossens (1990)&quot;</td>
<td>75</td>
<td>Sensitivity (S)</td>
<td>15</td>
<td>C</td>
<td>15</td>
<td>64</td>
<td>.26</td>
</tr>
<tr>
<td>&quot;Cox (1992)&quot;</td>
<td>33</td>
<td>Sensitivity, warmth, level of activity, stimulation (SS)</td>
<td>3</td>
<td>P</td>
<td>12.5</td>
<td>63</td>
<td>.43</td>
</tr>
<tr>
<td>&quot;Grossmann (1992)&quot;</td>
<td>46</td>
<td>Interactive smoothness, empathy (S)</td>
<td>2, 6, 10</td>
<td>P</td>
<td>18</td>
<td>41</td>
<td>.03</td>
</tr>
<tr>
<td>&quot;Volling (1992)&quot;</td>
<td>113</td>
<td>Responsiveness, stimulation (SS)</td>
<td>3, 9</td>
<td>P</td>
<td>18</td>
<td>80</td>
<td>.16</td>
</tr>
<tr>
<td>&quot;Schneider Rosen (1993)&quot;</td>
<td>62</td>
<td>Paternal acceptance, quality of assistance (SS)</td>
<td>21.5</td>
<td>C</td>
<td>21.5</td>
<td>69</td>
<td>.00</td>
</tr>
<tr>
<td>&quot;Caldera (1995)&quot;</td>
<td>90</td>
<td>Positive regard, sensitivity to nondistress, intrusiveness (SS)</td>
<td>6</td>
<td>P</td>
<td>18</td>
<td>68</td>
<td>.16</td>
</tr>
<tr>
<td>Braungart-Rieker (2001)</td>
<td>86</td>
<td>Sensitivity, intrusiveness (SS)</td>
<td>4</td>
<td>P</td>
<td>13</td>
<td>68</td>
<td>.11</td>
</tr>
<tr>
<td>Volling (2002)</td>
<td>62</td>
<td>Sensitivity, intrusiveness (SS)</td>
<td>12.5</td>
<td>C</td>
<td>12.5</td>
<td>60</td>
<td>.00</td>
</tr>
<tr>
<td>Eidin (2002)</td>
<td>220</td>
<td>Sensitive responding, negative affect, positive involvement (S)</td>
<td>13.5</td>
<td>C</td>
<td>13.5</td>
<td>61</td>
<td>.14</td>
</tr>
<tr>
<td>Kochanska (2005)</td>
<td>100</td>
<td>Responsiveness (S)</td>
<td>7</td>
<td>P</td>
<td>15</td>
<td>66</td>
<td>.00</td>
</tr>
<tr>
<td>Schoppe-Sullivan (2006)</td>
<td>91</td>
<td>Sensitivity (S)</td>
<td>12</td>
<td>C</td>
<td>12</td>
<td>64</td>
<td>.17</td>
</tr>
<tr>
<td>Wong (2009)</td>
<td>62</td>
<td>Sensitivity (S)</td>
<td>3.5</td>
<td>P</td>
<td>13</td>
<td>64</td>
<td>.24</td>
</tr>
<tr>
<td>Hazen (2010)</td>
<td>105</td>
<td>Sensitivity (S)</td>
<td>8</td>
<td>P</td>
<td>13.5</td>
<td>59</td>
<td>.00</td>
</tr>
<tr>
<td>Lucassen (2010)</td>
<td>84</td>
<td>Sensitivity, cooperation (SS)</td>
<td>14</td>
<td>C</td>
<td>14</td>
<td>68</td>
<td>.20</td>
</tr>
</tbody>
</table>

**Note.** References marked with an asterisk indicate studies included in the meta-analysis conducted by Van IJzendoorn and De Wolff (1997).
security would emerge across the past three decades. Although family sociologists report on increased participation in positive engagement activities of the father with their child (Pleck, 2010), we failed to find evidence for its increasing effect on infant attachment. This might, however, be influenced by selective participation of fathers in family research. Fathers who participate in research tend to be more involved in family life than nonparticipating fathers (Costigan & Cox, 2001), which might result in less variability in parenting behaviors like sensitivity. Third, because of the larger number of studies on fathers, we were able to differentiate the traditional assessment of sensitivity from sensitivity combined with stimulation which is suggested to be a paternal “specialization” (Grossmann et al., 2008; Naber, Van IJzendoorn, Deschamps, Van Engeland, & Bakermans-Kranenburg, 2010). However, we failed to find evidence for the hypothesis that fathers’ sensitivity combined with stimulation during play and other challenging situations promotes attachment security more than sensitive interactions without stimulation; nor did other moderator analyses (year of publication, sample size, the age of the child at the time of assessment of attachment security, percentage secure, and study design) show significant effects. It should be noted that these moderator analyses need to be interpreted with caution because of the small number of studies. The relatively small number of studies is a general limitation of this meta-analysis.

The quality of parenting behavior accounts for a small portion of the explained variance in individual differences in attachment security. The small effect size of the association between paternal sensitivity and infant–father attachment seems to imply that little can be gained from prevention or intervention strategies directed at increasing paternal sensitivity. Nevertheless, interventions based on small effect sizes can yield substantial benefits. A striking example was shown in a major biomedical research on the association between aspirin intake and risk of myocardial infarction (heart attack). Although the effect size of .034 was consid-

### Table 2

Meta-Analytic Results on the Association Between Paternal Sensitivity and Infant–Father Attachment Security

<table>
<thead>
<tr>
<th></th>
<th>k</th>
<th>N</th>
<th>r</th>
<th>Confidence interval 95%</th>
<th>Homogeneity Q</th>
<th>Contrast Q</th>
<th>Contrast P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total set</td>
<td>16</td>
<td>1,355</td>
<td>.12*</td>
<td>.06,.17</td>
<td>12.80</td>
<td>0.00</td>
<td>.96</td>
</tr>
<tr>
<td>Sensitivity measure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sensitivity</td>
<td>7</td>
<td>569</td>
<td>.12*</td>
<td>.03,.20</td>
<td>6.04</td>
<td>0.02</td>
<td>.89</td>
</tr>
<tr>
<td>sensitivity + stimulation</td>
<td>9</td>
<td>786</td>
<td>.12*</td>
<td>.05,.19</td>
<td>6.77</td>
<td>1.15</td>
<td>.28</td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>concurrent</td>
<td>7</td>
<td>669</td>
<td>.12*</td>
<td>.05,.20</td>
<td>4.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>predictive</td>
<td>9</td>
<td>686</td>
<td>.11**</td>
<td>.04,.19</td>
<td>7.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age SSP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 to 15 months</td>
<td>12</td>
<td>1,082</td>
<td>.13**</td>
<td>.07,.19</td>
<td>10.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 months and older</td>
<td>4</td>
<td>273</td>
<td>.06</td>
<td>-.06,.18</td>
<td>1.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.

![Figure 1. Forest plot of the studies included in the cumulative meta-analysis with the effect sizes and 95% confidence intervals. The combined effect size is r = .12; k = 16; N = 1,355; p < .001.](image-url)
ered to be very small, it suggested that 3.4% fewer persons who would probably experience a heart attack will not experience it if they follow the regimen as prescribed in the aspirin treatment condition (Rosnow & Rosenthal, 1989). As Rose described (in his discussion of the “prevention paradox”; 1981), even moderate alterations of modest risk factors can achieve major public health benefits.

The significant and replicable effect of modest size may be relevant as few father determinants of infant–father attachment are established and because a secure attachment relationship is predictive for positive developmental outcomes of the child. Moreover, sensitivity is amenable to interventions. Intervention studies aimed at increasing sensitivity and attachment security in mothers and their infants appeared to be effective, and more successful sensitivity interventions were also more effective in enhancing infant attachment security (Bakermans-Kranenburg et al., 2003). Interventions involving fathers appeared to be more effective than interventions focusing on mothers only. The number of intervention studies on fathers is too small to be included in a meta-analysis in a way similar to the meta-analysis on mother–infant interventions (Bakermans-Kranenburg et al., 2003). Although most studies in the current meta-analysis had a predictive design with the assessment of sensitivity conducted several months before the Strange Situation Procedure, only experimental intervention studies can establish a causal relation.

Besides sensitivity and stimulating play, other determinants may facilitate a secure infant–father attachment relationship. Previous studies have shown that fathering is influenced, more than mothering, by contextual factors in the family such as marital satisfaction (Belsky, 1996) and coparental relationship quality (Brown, Schoppe-Sullivan, Mangelsdorf, & Neff, 2010). Studies focusing on the family system (e.g., Schoppe-Sullivan et al., 2006) might give more insight into the specific role of the father in the development of the child. Such studies could also examine whether the father has a more direct or a more buffering effect on child development. Future research should focus on the causal relation between paternal sensitivity and infant–father attachment, as well as other possible determinants of infant–father attachment security. Given the few extant studies looking at the infant–father attachment relationship, we recommend that future studies utilize a family systems perspective (Cowan, 1997) in the continuing search for the multiple predictors of infants’ secure attachments to their fathers.

References

References marked with an asterisk indicate studies included in the meta-analysis.


Mangelsdorf, & Neff, 2010). Studies focusing on the family system (e.g., Schoppe-Sullivan et al., 2006) might give more insight into the specific role of the father in the development of the child. Such studies could also examine whether the father has a more direct or a more buffering effect on child development. Future research should focus on the causal relation between paternal sensitivity and infant–father attachment, as well as other possible determinants of infant–father attachment security. Given the few extant studies looking at the infant–father attachment relationship, we recommend that future studies utilize a family systems perspective (Cowan, 1997) in the continuing search for the multiple predictors of infants’ secure attachments to their fathers.


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