

Sensitivity as a Privileged Predictor of Attachment:

A Second Perspective of De Wolff and van IJzendoorn's Meta-Analysis

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Over the past three decades, Ainsworth's seminal attachment study has influenced the field of child development (Ainsworth, Blehar, Waters, & Wall, 1978). Some researchers have questioned the validity of the strong correlation between maternal sensitivity and attachment security ($r = .78$) and the importance of following Ainsworth's intensive observational methods (Lamb et al., 1985). De Wolff and van IJzendoorn (1997) tested the hypothesis that studies using a similar construct of maternal behavior and methodology as used in Ainsworth's original study yielded stronger associations between maternal behavior and attachment security.

Research studies have examined different types of maternal behavior in relationship to attachment. Apparently, frequent parental response alone may not encourage strong attachment bonds. Infants classified as having avoidant-insecure attachment are likely to have caregivers who respond more frequently to the infant than secure infants (Belsky, Rovine, & Taylor, 1984). Insecure attachment is related to frequent responsiveness when maternal behaviors are inappropriate (Isabella & Belsky, 1991). These inappropriate responses may be either intrusive or merely inconsistent with the infant's signals. Thus, the measurement of sensitivity is distinguished from responsiveness by emphasizing behaviors that are correctly timed (i.e., synchronous) and mutually rewarding.

De Wolff and van IJzendoorn's meta-analysis measured effects of nine types of maternal behavior. Their study concluded that seven types of maternal behaviors other than sensitivity, including physical contact, cooperation, synchrony, mutuality, support, positive maternal attitude and maternal stimulation, yielded equally strong associations with attachment. Contiguity of behavior, defined as frequency or promptness of response, was the only type of maternal behavior that yielded significantly weaker associations with attachment than sensitivity.

Because these nine types of maternal behavior were considered to be qualitatively different, the authors measured the effectiveness of Ainsworth-like methodology through nine separate meta-analyses of studies within each behavior type. In general, Ainsworth's methods, such as home-based measurement and lengthy observations, did not increase the strength of the associations between attachment and maternal behavior. The resemblance of the maternal behavior type to Ainsworth's definition of sensitivity was not indicative of stronger effects. Yet, a different combination of variables within De Wolff and van IJzendoorn's meta-analysis led to the opposite conclusion. From both a theoretical and an empirical standpoint, the variables of sensitivity, synchrony, and mutuality appear to be similar. Our premise is that synchronous, mutual interaction is essential to the nature of sensitivity. Thus, we combined studies of these types of behavior to represent sensitivity.

Methodology of De Wolff and van IJzendoorn's study. For the purposes of clarification, the method of grouping maternal behaviors in De Wolff and van IJzendoorn's meta-analysis method will be reviewed briefly. Their comprehensive search of the literature, including some unpublished work, yielded 66 studies of maternal behavior and attachment security. These studies contained 123 effect sizes; several studies measured

more than one type of maternal behavior. Initially, fifteen categories of maternal behaviors were formed, representing roughly half of their effects. These categories were reduced to four self-evident groups: sensitivity, contiguity of response, physical contact, and cooperation.

The constructs underlying remaining effect sizes were more difficult to classify. A complex procedure classed these constructs into five groups: synchrony, mutuality, support, positive attitude, and stimulation. First, measures of maternal behavior were sorted into 40 constructs. Twenty-seven experts and graduate students then sorted the 40 constructs into homogeneous groups and rated them according to their similarity to Ainsworth's definition of sensitivity. The data were then analyzed using a homogeneity analysis with alternating least squares (HOMALS). The groups synchrony and mutuality were adjacent to each other (i.e., similar) in the HOMALS solution. An additional cluster analysis of the 40 constructs supported the existence of five groups of constructs. The five construct groups developed from the sorting procedure and the four initial groups comprised the nine behavior types central to De Wolff and van IJzendoorn's analyses. It is unclear whether the same nine construct groups would have emerged if all 123 effect sizes had been sorted and rated by the 27 experts.

Sensitivity, Mutuality, and Synchrony. Although the sorting process used by De Wolff and van IJzendoorn is empirically interesting, it lacks a strong theoretical basis. The results of this analysis placed sensitivity, mutuality, and synchrony into three separate behavior types. The construct of sensitivity was defined on face value. Effect sizes were placed into the sensitivity behavior type if they used Ainsworth's original sensitivity definition: "The optimally sensitive mother is able to see things from her baby's point of

view. She is alert to perceive her baby's signals, interprets them accurately, and responds appropriately and promptly. . . temporally contingent upon the baby's signals" (Ainsworth et al., 1978, p. 142). While mutuality and synchrony emerged from the empirical sorting process, their definitions are indeed similar to this definition of sensitivity.

Studies in the mutuality and synchrony groups appear to define maternal behavior as appropriate responsiveness. For example, the effect from the Isabella and Belsky study (1991) was placed in the synchrony group rather than the sensitivity group. In this study, maternal behavior was scored as highly synchronous if it reflected "reciprocal and mutually rewarding behavioral exchanges" and highly asynchronous if the mother failed "to respond in an optimally sensitive manner to infant signals." Isabella and Belsky's measure appears to identify the same concept of sensitivity as measures from studies included in the sensitivity group.

Additional examples included two studies from the sensitivity group that used the Maternal Behavior Q-Set (Pederson & Moran, 1996; Pederson, Moran, Sitko, Campbell, Ghesquire, and Acton, 1990). Items included in the Maternal Behavior Q-Set appear similar to Isabella & Belsky's construct of maternal sensitivity, e.g., "interactions revolve around baby's tempo and current state" and "interprets cues correctly as evidenced by baby's response." Studies in the sensitivity category often used global rating scales to measure this concept (e.g., Stifter, Couleham, & Fish, 1993). Such global rating scales emphasize "appropriate, well-timed, synchronous behavior. . . facilitating baby's self-regulation . . . [and] following the baby's lead and signals" (Fish, Stifter, & Belsky, 1991).

Given the similarity of the definitions of sensitivity, synchrony, and mutuality, our analyses redefined the sensitivity category as inclusive of studies in the synchrony and

mutuality groups. We believe that it may be fruitful to examine together the maternal behaviors labeled by De Wolff and van Ijzendoorn as sensitivity, synchrony, and mutuality.

Methods

We recomputed the importance of maternal behavior based on effect sizes and confidence intervals from De Wolff and van Ijzendoorn's paper. The three groups that measure sensitive maternal behavior--sensitivity, synchrony, and mutuality--appear to have similar effect sizes. A visual inspection of the confidence intervals surrounding the mean correlation between maternal behavior and attachment indicates that these three sets of studies are homogeneous. As Figure 1 shows, a horizontal line can be drawn that intersects all three confidence intervals for the individual mean effects of sensitivity, mutuality, and synchrony. In addition, the remaining six groups that do not measure sensitivity per our definition are also similar to each other. A horizontal line drawn at the mean of these groups' effects (0.14) would intersect confidence intervals for the remaining groups. In addition, the associations between sensitivity, synchrony, and mutuality and secure attachment are stronger than associations for the six other constructs measuring maternal behavior, such as stimulation and physical contact.

It might be noted that the effect sizes for the groups of cooperation, attitude, and stimulation in the original paper are not in the center of the confidence interval. We used original data to recompute the effect sizes and confidence intervals (De Wolff, 1996). De Wolff and van Ijzendoorn had included two studies that were not in De Wolff's dissertation (Fagot & Kavanagh, 1990; Malatesta et al., 1989). It was not possible to calculate an effect size from the Fagot and Kavanagh article due to the fact that it does not

include separate measurements of maternal behavior; in addition, data measured relationships between insecure-avoidant and secure classifications only, eliminating insecure-resistant and mixed classifications from the analyses (15% of the total sample). An effect size for the Malatesta et al. article was calculated and included in the recalculation of the confidence interval for this group.

The original study used focused comparison of combined effect sizes to show the effects of moderators, such as time of assessment, home observation, and study quality, on the strength of the correlation between maternal behavior and attachment (Rosenthal & Rosnow, 1985). The purpose of this analysis was to explain the variation in effect sizes within behavior-type groups. We tested whether a potential moderator (e.g., these behavior-type groups) gave sufficient explanation of differences in study outcomes using data presented by De Wolff and van IJzendoorn (1997). In addition, we analyzed groups of studies to determine group means.

Results

The test for significance of a moderator variable uses a chi-square statistic. As mentioned previously, De Wolff and van Ijzendoorn's 123 effect sizes were divided into nine behavior-type groups: sensitivity ($k = 30$), contiguity of response ($k = 14$), physical contact ($k = 9$), cooperation ($k = 9$), synchrony ($k = 6$), mutuality ($k = 3$), support ($k = 22$), attitude ($k = 21$), and stimulation ($k = 9$). As the authors acknowledged, homogeneity within groups is necessary for combining effect sizes. The test for homogeneity within the groups is found in Table 1 of the original paper. This chi-square test, referred to as a test of homogeneity or a Q test, assesses whether or not the effect sizes represent a single population of outcomes. The Q test determines whether

variability in effect sizes is due to sample differences or whether the studies are fundamentally different, perhaps due to study methodology. This statistic guards against the apples-oranges problem that was often cited by early critics of meta-analysis (Cronbach, 1982; Glass, 2001).

Another use for the Q test is the assessment of the importance of moderators. As in ANOVA, the sum of variation within the groups plus variation between the groups equals total group variation. By summing all nine of the chi-squares in Table 1 within De Wolff and van IJzendoorn's meta-analysis, we can obtain the total within-group chi-square (Q_{within} statistic) = 178. Then, by subtracting this number from the total chi-square given in table 1 ($Q_{\text{total}} = 198$), we calculate the chi-square statistic for the between group differences ($Q_{\text{between}} = 20$). The chi-square statistic ($df = 9 \text{ groups} - 1 = 8$) for this test ($p < .05$) = 15.51. Thus, the between-group differences explain a minimal amount of the variation. A comparison of the within group chi-square value of 178 to the chi-square statistic of 157 ($df = 123 \text{ effect sizes} - 9 \text{ groups} = 114$) indicates that there is a significant level of heterogeneity within groups ($p < .005$).

When the ratio of chi-squares of between-group differences to within-group differences is less than one, it is suggested that meta-analysts should look for another moderating variable (Hedges, 1994). In this case, that ratio is 0.1. Thus, if we use the Q statistic as the partitioning of the sums of squares in analysis of variance, the division of sensitivity-attachment correlations into these nine conceptual groups is not a good explanatory variable. Factor analysis often produces distinct conceptual groups, but theoretical bases are necessary to prevent the analyses from forming groups that are

merely idiosyncratic to the data. Perhaps the exclusion of half of the data from the analyses has created the ineffectiveness of the division into nine groups.

The question then arises as to whether sensitive maternal behavior, defined as sensitivity, mutuality, and synchronicity, yields higher correlations between maternal behavior and attachment security than other measurements. Once again, data from this study provides the answer. The confidence intervals discussed above are derived by the mean effect size $\pm 1.96\sqrt{\text{variance}}$. In calculating variances for each group, we used the upper limit of each confidence interval (ulim). Working backwards from the confidence intervals, we obtain $[(\text{ulim} - t)/1.96]^2$ for the variances. Using Rosenthal's method of contrast analysis (Rosenthal & Rosnow, 1985), we obtain the formula:

$$\frac{1/3(\sum T_{\text{sensitivity, synchronicity, and mutuality groups}}) - 1/6(\sum T_{\text{six remaining groups}})}{1/9(\sum V_{\text{sensitivity, synchronicity, and mutuality groups}}) + 1/36(\sum V_{\text{six remaining groups}})} = 4.42$$

This number (4.42) is a z-score, indicating that the correlation between sensitive maternal behavior and attachment security is significantly higher than the correlation of the measurement of other maternal behaviors and attachment security ($p < .001$). The inaccuracy of the confidence intervals in van IJzendoorn and De Wolff's paper did not change the significance of this finding, i. e., both the inaccurate data and the corrected data yielded similar results. Thus, sensitivity as a construct, according to our conceptualization, yields significantly stronger correlations with attachment than other types of maternal behavior.

Discussion

In the discussion section of De Wolff and van Ijzendoorn's (1997) meta-analysis, the authors concluded that, "sensitivity has lost its privileged position as the only

important causal factor (p.585)". It is debatable whether sensitivity has been considered to be the only important causal factor; however, it is certainly central to Bowlby's (1969) original theory. De Wolff and van IJzendoorn also concluded that seven types of maternal behaviors other than sensitivity yielded equally high correlations with attachment. Yet these conclusions are based on divisions of studies into nine groups that were formed through a combination of personal judgment and mathematical analyses rather than an overarching theoretical base.

As a result of the De Wolff and van IJzendoorn meta-analysis, researchers have been encouraged to examine additional correlates of attachment. Certainly, recent interest in other correlates of attachment security, such as emotional regulation, fathering, and marital conflict has yielded informative studies. Yet the view of conceptualization and operationalization of maternal behavior as unimportant has negated some earlier research.

For example, research has indicated that stimulation is not the best marker of attachment security; frequent stimulation may be more indicative of avoidant attachment than secure attachment (Isabella, Belsky, & von Eye, 1989). Too much stimulation is considered to be difficult for infants to manage; parents who are overinvolved with their infants may undermine their emotional development (Brophy-Herb, 2001). The finding in our reanalysis that stimulation is not equal to sensitivity as a predictor of attachment security confirms such research. Certainly we agree with the conclusion that maternal behavior matters, and this is an important finding. Yet, the way that maternal behavior is defined and measured also matters, according to our secondary meta-analysis. Thus, researchers who have taken the original meta-analysis at face value have been encouraged

to investigate multiple types of maternal behavior with no particular emphasis on reciprocal, synchronous, and sensitive maternal behavior.

By redefining sensitivity as inclusive of reciprocal, synchronous behavior, we reach the conclusion that sensitivity is the most influential maternal behavior type as a predictor of attachment security. Inspection of group confidence intervals, contrast analysis, and a chi-square test of between-group differences all lead to the conclusion that our definition of sensitivity yields stronger relations with attachment than other types of maternal behavior.

Our study contradicts earlier findings that the effect of sensitive maternal behavior is not a stronger predictor of attachment than other types of maternal behavior. Van den Boon (1997) noted the possibility that studies using optimal research designs, measuring true sensitivity as "promptness, consistency, and appropriateness" on mother-child attachment may approach the effect size of Ainsworth's original study. Some laboratories have found large effect sizes (e.g., Pederson, Gleason, Moran, & Bento, 1998) while most effect sizes are small to medium. In general, our reanalysis confirms the finding that sensitive maternal behavior has a significant but modest effect on attachment security.

Limitations and future directions

As it is now apparent that it does matter how the central independent construct is conceptualized, the operationalization of the construct could also be reexamined as moderators, with the concept of sensitivity as a main effect. The second part of De Wolff and van IJzendoorn's paper describes the relation of effect size to various aspects of methodology only within nine groups. Their findings suggest that length of observation,

home vs. laboratory experiments, and age of assessment of maternal behavior are not relevant moderators. The lack of analysis across the total set of studies makes it difficult to view possible effects of time of assessment, home observation, and study quality on the strength of correlation between maternal behavior and attachment. In addition to examining other possible moderators, future research could examine other outcomes related to parenting that may have bearing on attachment relationships (Belsky, 1997).

In summary, De Wolff & van Ijzendoorn's meta-analysis provided some useful information. The authors assembled an extensive collection of studies examining the relationship between maternal behavior and attachment security. Yet, the division of the studies into nine essentially separate meta-analyses did not allow them to effectively address broader questions about the effects of moderators on the association between sensitivity and attachment. Furthermore, the duplicity of the sensitivity construct into three behavior-type groups diluted the test of between-group differences, obscuring the importance of the maternal behavior definition. Using a recombination of effects from their meta-analysis, we were able to conclude that sensitivity, defined as mutually rewarding and synchronous maternal behavior, is a significantly stronger predictor of attachment security than other types of maternal behavior, one that often predicts the formation of a secure attachment relationship.

References

- Ainsworth, M. D. S., Blehar, M. C., Waters, E., Wall, S. (1978). Patterns of attachment: A psychological study of the strange situation. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Belsky, J. (1997). Theory testing, effect-size evaluation, and differential susceptibility to rearing influence: The case of mothering and attachment. Child Development, 64, 598-600.
- Belsky, J., Rovine, M., & Taylor, D. G. (1984). The Pennsylvania Infant and Family Development Project II: Origins of individual differences in infant-mother attachment: Maternal and infant contributions. Child Development, 55, 706-717.

- Cronbach, L.J. (1982). Prudent aspirations for social inquiry. In W. H. Kruskal, (Ed.), The Social Sciences: Their Nature and Uses. Chicago: The University of Chicago Press, pp. 61-81.
- De Wolff, M. (1996). Maternal interactive behavior and infant attachment: A meta-analysis. (Doctoral dissertation, University of Leiden, 1996).
- De Wolff, M., & van IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. Child Development, 68, 571-591.
- Glass, G. V. (2001). Meta-analysis at 25. <http://glass.ed.asu.edu/gene/papers/meta25.html>.
- Hedges, L. (1994). Fixed effect models. In H. Cooper & L. V. Hedges (Eds.) The Handbook of Research Synthesis. Russell Sage Foundation: New York.
- Isabella, R. A. (1993). Origins of attachment: Maternal interactive behavior across the first year. Child Development, 64, 605-621.
- Isabella, R. A., Belsky, J., & von Eye, A. (1989). Origins of infant-mother attachment: An examination of interactional synchrony during the infant's first year. Developmental Psychology, 25, 12-21.
- Lamb, M. E., Thompson, R. A., Gardner, W., & Charnov, E. L. (1985). Infant-mother attachment: The origins and developmental significance of individual differences in Strange Situation behavior. Hillsdale, NJ: Erlbaum.
- Moher, D., Cook, D. J., Eastwood, S., Olkin, I., Drummond, R., & Stroup, D. F. (1999). Improving the quality of reports of meta-analyses of randomized controlled trials: the QUOROM statement. The Lancet, 354, 1896-1900.
- Rosenthal, R. & Rosnow, R. L. (1985). Contrast analysis: Focused comparisons in the analysis of variance. Cambridge: Cambridge University Press.

Figure 1. Confidence interval plots of effect sizes of maternal behavior and attachment: (1) sensitivity, (2) synchrony, (3) mutuality, (4) contiguity, (5) physical contact, (6) cooperation, (7) support, (8) attitude, and (9) stimulation.

