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ATTACHMENT SECURITY: A META-ANALYSIS OF MATERNAL MENTAL HEALTH CORRELATES

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ABSTRACT. *This meta-analysis addresses the association between attachment security and each of three maternal mental health correlates. The meta-analysis is based on 35 studies, 39 samples, and 2,064 mother–child pairs. Social–marital support (r = .14; based on 16 studies involving 17 samples and 902 dyads), stress (r = .19; 13 studies, 14 samples, and 768 dyads), and depression (r = .18; 15 studies, 19 samples, and 953 dyads) each proved significantly related to attachment security. All constructs showed substantial variance in effect size. Ecological factors and approach to measuring support may explain the heterogeneity of effect sizes within the social–marital support literature. Effect sizes for stress varied according to the time between assessment of stress and assessment of attachment security. Among studies of depression, clinical samples yielded significantly larger effect sizes than community samples. We discuss these results in terms of measurement issues (specifically, overreliance on self-report inventories) and in terms of the need to study the correlates of change in attachment security, rather than just the correlates of attachment security per se.* © *2000 Elsevier Science Ltd.*

KEY WORDS. Attachment, Mental health, Meta-analysis.

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ATTACHMENT SECURITY: A META-ANALYSIS OF MATERNAL MENTAL HEALTH CORRELATES

SINCE THE EARLY work by Ainsworth (Ainsworth, Blehar, Waters, & Wall, 1978), studies have "consistently (but not universally)" confirmed the link between maternal sensitivity and attachment security (Belsky & Isabella, 1988, p. 45). Based on meta-analytic reviews, Atkinson et al. (in press), De Wolff and van IJzendoorn (1997), and Goldsmith and Alansky (1987) reported mean effect sizes of $r = .32$, .24, and .27, respectively, linking sensitivity and attachment security (although effect sizes vary across studies, depending on how, when, and within what sample sensitivity was measured). The De Wolff and van IJzendoorn (1997) analysis, in particular, included 66 studies and 4,176 mother–child dyads, reflecting the tremendous effort directed to this enterprise by the research community.

As Belsky and Isabella (1988) pointed out, however, "factors beyond the specific interactions that transpire between mother and infant also serve to influence the development of attachment security, if only because they are likely to affect the very behavioral exchanges that take place between mother and infant" (p. 45). Yet investigation of these distal factors (including maternal characteristics such as mood state and anxiety and social contextual factors like marriage and social support) remains relatively "unintegrated and underutilised" (Belsky, 1984, p. 83).

The meta-analysis (van IJzendoorn, 1995) of parental states of mind with respect to attachment (operationalized with the Adult Attachment Interview; George, Kaplan, & Main, 1985) as a predictor of infant attachment security represents an important exception to this state of affairs. By integrating this literature, van IJzendoorn (1995) demonstrated that the distal factor of parental mental state was, in fact, a more powerful predictor of infant attachment security than was the proximal variable maternal sensitivity. This finding opened a new avenue of research aimed at explaining the *transmission gap*, the means by which parents communicate their own states of mind with respect to attachment if not through differentially sensitive interaction. More generally, the counter-theoretical findings of van IJzendoorn (1995) indicate the need for an integrated review of other distal predictors of attachment security. In this article, we present meta-analyses of three distal correlates of attachment security that are pertinent to mental health: social–marital support, stress, and maternal depression. The need to study mental health variables as they relate to attachment security, itself a predictor of psychopathological status (Atkinson & Zucker, 1997), has increased as attachment researchers have moved from studying developmental concerns to addressing issues of psychological–psychiatric adjustment (Atkinson, 1997; Cicchetti, Toth, & Lynch, 1995).

Although we advance a few hypotheses in the sections that follow, we attempted to limit expectations for three reasons:

1. Our strongest and broadest expectation, that distal constructs would explain less variance in attachment security than would maternal sensitivity, had already been refuted (van IJzendoorn, 1995).
2. An ironic aspect of meta-analyses is that one derives hypotheses from the very literature, or the very database, one is analyzing. Hence, there is a danger of confounding hypotheses with post hoc theorizing.
3. Paradoxically, our third reason for limiting the number of hypotheses constituted an expectation in and of itself.

Most research on distal correlates of attachment relies exclusively on self-report inventories to assess the correlates in question. We expected the use of such measures to deflate and homogenize effect sizes across constructs, rendering specific hypotheses about the comparative strengths of these correlates difficult to validate. For example, investigators (e.g., Budd & Heilman, 1992; Norton, 1983) have warned of numerous psychometric problems where self-report measures of marital satisfaction are concerned. Stress inventories have been criticized as inaccurate (Costello & Devins, 1988) and contextually insensitive (Coyne & Whiffen, 1995). Self-reported depression in community samples may be inaccurate (Field et al., 1991) and unstable (Coyne, 1994).

In any case, as well as measuring the direct associations between distal correlates of attachment security and attachment security itself, we evaluated the moderating effects of the publication process (publication status [published vs. unpublished], year of publication), contextual variables (e.g., environmental risk status), and methodological issues, including attachment measure (Strange Situation,[1] modified Strange Situation, or Attachment Q-set[2]), and coding scheme (avoidant, [A], secure [B], ambivalent–resistant [C], vs. ABC and disorganized [D][3]). In addition, we studied temporal factors (age of child at attachment assessment, time between assessments of the distal correlate, and attachment security). We considered this last moderator, time between the assessment of distal correlate and attachment security, particularly important. Meta-analyses of sensitivity and attachment security have consistently indicated that time separating assessments is significantly related to effect size; greater time is associated with smaller effect sizes (Atkinson et al., in press; De Wolff & van IJzendoorn, 1997; Goldsmith & Alansky, 1987). Such findings provide an opportunity to explore the flexibility of the internal working models that purportedly underlie quality of attachment. Before describing the present meta-analysis, we provide synopses of the literature in each domain of interest.

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[1]The Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978) is a 24-minute laboratory procedure that involves observing the infant in a comfortable but unfamiliar room with mother, with mother and a stranger, with the stranger, and alone across multiple 3-minute episodes. The infant's attachment security is coded based on his–her behavior under these circumstances, particularly with respect to his–her behavior during reunions with mother. The Strange Situation yields a typology of attachment security.

[2]The Attachment Q-set (Waters & Deane, 1985) is an observational technology wherein the participant is observed in and around the home interacting with his–her mother. Following observation, observers sort a set of Q-set cards into nine piles according to the accuracy of statements describing the participant (from *very like* to *very unlike*). Scores are then correlated with the prototypic securely attached child (as determined by a group of experts) and the participant is assigned a score on a continuum of insecurity–security.

[3]Insecure–avoidant infants tend to avoid their mothers on reunion and downplay overt manifestations of negative emotion. They orient towards the environment, rather than their caregiver. Secure infants greet their mothers upon her reentry, calm quickly if distressed, express negative emotion openly, and balance orientation to caregiver and environment. Insecure–ambivalent/resistant infants are not easily calmed on reunion with their caregivers, hyperactivate emotional display, and orient toward caregiver rather than environment. The disorganized infant lacks an organized strategy for dealing with mother on reunion, at times showing extreme ambivalence in approaching and avoiding mother. Unlike avoidance, security, and ambivalent–resistance, disorganization is not a classification per se, but a dimension that may accompany any of the aforementioned classifications.

SOCIAL–MARITAL SUPPORT

Social support has been defined in various ways: as involving close relations with a variety of intimates, including spouse, extended family members, and good friends; as the perception that one is loved, respected, and part of a network of mutual obligations; and as access to the exchange of material goods, information, and problem-solving strategies (Brandt & Weinert, 1981). Social support may involve contact with the professional community (Jacobson & Frye, 1991), including medical practitioners, counsellors, child welfare workers, and others. Attempting to encapsulate "this broad yet unspecified domain" (Brandt & Weinert, 1981, p. 277), many social support measures incorporate all these definitions. For example, Crockenberg (1981) and Ward, Kessler, and Altman (1993) interviewed each mother about:

> whom she knows; how much, how often, and with what each persons [sic] helps; and whether she receives the help she needs. Questions concerned . . . support from partner, family members, friends, and professionals. The interview yielded data on frequency, kind, and amount of support. (Ward et al., 1993, p. 215)

Ultimately, such data are combined into a single composite score. In the present study, we combine social support and marital satisfaction studies into a single meta-analysis, reflecting the lack of differentiation in many of the primary studies from which we extracted effect sizes.

The general hypothesis is that social support–marital satisfaction influences the mother's experience of child rearing and thereby affects her interaction with the child (Belsky, Rosenburger, & Crnic, 1995a, 1995b). For example, Crockenberg (1981) interviewed mothers of 3-month-olds about support (from husband, extended family, and others) and stress. Based on ratings of support relative to stress, Crockenberg successfully predicted infant attachment security, as assessed 9 months later in the Strange Situation. Or again, Jacobson and Frye (1991) randomly assigned women on a federally funded food supplementation program to a nonintervention group or a group involving home-visits by a coach. At 14 months, the experimental group infants proved more secure than their control peers, as measured with the Attachment Q-set. This study apparently provided experimental evidence for the hypothesis that maternal support positively influences security.

While such findings appear convincing, Nakagawa, Teti, and Lamb (1992) reported the exact opposite relation. The researchers administered three scales of marital and other social support to the wives of Japanese executives visiting the United States. Observers concurrently rated the security of the preschool children of the couples with the Attachment Q-set. The composite social support score correlated at a significant $r = -.31$ with security of attachment, i.e., the greater the support, the less secure the infant.

Implicit in this survey is variation in measurement of both social support (interview, intervention, and inventory) and attachment security, in age of infant at attachment assessment, and in time between measurement of social support and attachment security. We examine potential moderating variables such as these in the present meta-analysis.

MATERNAL STRESS

Investigators have assessed two broad sources of stress, life events stress (e.g., Vaughn, Egeland, Sroufe, & Waters, 1979) and parenting stress (e.g., Nakagawa et al., 1992). In

terms of life events and stress, caregivers who are preoccupied (physically, psychologically, or both) with one or more stressors are less likely to respond appropriately to child signals. In addition, life-event stressors may affect mother and child independently and simultaneously. Findings with reference to life-event stress are inconsistent, with some investigators reporting significant positive associations between life-event stress and attachment security (Manassis, Bradley, Goldberg, Hood, & Price-Swinson, 1994; Tarabulsy et al., 1995) and others reporting no such association (Jacobson & Frye, 1991; Phillips, 1990).

By contrast, parenting stress involves the perception of challenges presented by the behavior of the child and feelings of competence in parenting. The concept of parenting stress sits at the interface between the personality of the mother and her interaction with the child, such that one would expect high stress, almost by definition, to reflect the nature of mother–child interaction. Many studies (e.g., Manassis et al., 1994; Teti, Gelfand, Messinger, & Isabella, 1995) have confirmed the hypothesized relation between parenting stress and attachment security, although this is not always the case (Hellstrom, 1994).

All attachment investigators have assessed maternal stress with self-report inventories. However, they have chosen a variety of attachment measures (Strange Situation, variations thereof, Attachment Q-set) to assess a variety of samples (e.g., employed, adolescent, depressed, and clinically anxious mothers; typically developing, preterm, and failure-to-thrive infants) across a broad span of time. We address the potentially differential impact of methodology and sampling in this meta-analysis.

MATERNAL DEPRESSION

Given the link between caregiving sensitivity and attachment, an infant whose parent has a disturbance that may impede caregiving is considered at risk for insecure attachment. Clinical depression is one such disturbance. The psychological and, possibly, physical unavailability of a parent during depressive episodes may influence child expectations of the caregiver as accessible and responsive (Cummings & Cicchetti, 1990; Cummings & Davies, 1994). In addition, infants of affectively disturbed parents are likely to experience episodes of maternal sadness, irritability, hopelessness, helplessness, and confusion (Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985). Moreover, factors such as increased marital conflict, assortative mating, adverse interpersonal environment for both parents and children, comorbid diagnoses, and genetic factors, all associated with maternal depression (Dodge, 1990; Downey & Coyne, 1990; Radke-Yarrow et al., 1995), may increase the probability of insecure attachment. Studies of clinically diagnosed samples often show significant relations between maternal depression and attachment security in the early years (e.g., D'Angelo, 1986; Murray, 1992). However, Radke-Yarrow et al. (1995) found that the relation between maternal depression and security status held only for bipolar disorder, not for clinical depression in general. Meta-analytic procedures may help in reaching generalizable conclusions.

Other investigators focus on community samples (Spieker & Booth, 1988; Teti, Nakagawa, Das, & Wirth, 1991), assessing depression with a variety of self-report inventories and again proposing that maternal mood adversely affects sensitive caregiving. It is important to note, however, that clinical depression and self-reported depression are distinct phenomena, with clinical depression representing a more intense, extensive, and

stable form of disturbance (Coyne, 1994; Coyne & Gotlib, 1983). Under these circumstances, one might expect that clinical depression would have a more negative impact on attachment than would self-reported depression in community samples. Cummings and Davies (1994) cited the diversity of sampling within depression and attachment studies as one possible reason that "a wide range of outcomes are found" (p. 82).

Methodologies for assessing attachment security within studies of depression include the Strange Situation and modifications of the Strange Situation. These have been coded using the ABC and the ABCD schemes. This is an important distinction in the study of maternal depression, given that depression may be strongly linked to disorganized attachment (Radke-Yarrow et al., 1985). Overall, questions remain concerning the strength of association between depression and child attachment security and what factors moderate that association.

In sum, attachment research remains confusing for several reasons, not least of which is the sheer size of its "sprawling literature" (Lamb, 1987, p. 822). Investigators have examined numerous constructs in diverse populations using varied instrumentation. The purpose of this meta-analysis is to combine, compare, and contrast findings on maternal mental health correlates of attachment security.

METHOD

Selection of Studies

We searched for all studies that examined the relation between distal maternal variables and quality of attachment using the *Psychological Abstracts*, *MedLine*, and *Dissertation Abstracts International* databases, going back to 1970. The keywords "infant/child attachment" were used as the main descriptors in conjunction with "Strange Situation," "Attachment Q-set," and multiple maternal descriptors. The reference lists from retrieved studies were used to identify further relevant studies, as was consultation with colleagues.

We included studies if: (a) attachment correlates were measured prior to, or concurrently with, attachment security; (b) attachment security was assessed with the Strange Situation, a modified Strange Situation, or the Attachment Q-Set; (c) the children were between the chronological ages, mental ages, or both of 12 and 36 months; (d) samples were composed entirely of mother–child dyads; and (e) publication was in English. When reported data were insufficient to calculate an exact effect size, we requested information from the investigators. If this was not forthcoming, the study was excluded from analysis. These criteria resulted in the inclusion of 35 studies with 39 samples (some studies included multiple samples) and 2,064 dyads; 16 studies (17 samples, 902 dyads) addressed social–marital support, 13 studies (14 samples, 768 dyads) involved stress; and 15 studies (19 samples, 953 dyads) addressed depression.[4]

Meta-Analytic Procedure

We calculated effect sizes as Pearson correlation coefficients (r) using the guidelines of Rosenthal (1991). Most studies included one or more attachment correlates, one

[4]The breakdown involves overlapping samples so the total samples and participants within each domain do not equal the overall totals for the meta-analysis.

or more attachment measures, or both, resulting in multiple effect sizes. To avoid disproportionate representation of individual samples, a single mean effect size (based on the Fisher z_r transformation and weighted by sample size) was calculated for each relevant construct and each sample.

To ensure that effect sizes were robust, we computed a *z*-statistic (determining significance level) and a file drawer statistic. Because of the bias toward significant findings in published reports (Bakan, 1966), and consequent inflation of effect size, the file drawer statistic serves to estimate the number of unretrieved studies averaging null results that would reduce the significance of the meta-analytic findings to the just significant level, $p = .05$ (Rosenthal, 1991). We conducted a χ^2 procedure to determine if interstudy effect size differences reflected more than mere error variance and disjoint cluster analyses to identify nonoverlapping clusters of studies (Rosenthal, 1991). We also tested variation using the appropriate nonparametric statistics (Mann-Whitney *U*, Kruskall-Wallis ANOVA, Spearman ρ).

Where effect size was related to time between assessment of the maternal variable and of attachment security, we measured rate and pattern of change in effect size using nonlinear regression. A linear function predicting effect size does not make theoretical sense because linearity implies that effect sizes will drop below zero, in predictable fashion, as the time separating sensitivity and attachment assessments lengthens. In this case, we must think of an effect size based on the relationship between two measures as at a maximum when measured concurrently and as approaching zero as time passes. This is captured by an inverse function such as $y = 1/x$. The value of y (effect size) approaches 0.0 asymptotically as x (time) increases, but never reaches 0.0.

A further consideration in building a regression equation involves the sample sizes upon which the effect sizes are based. It is reasonable to expect that the standard error of the measure of effect size is proportional to the square root of sample size (as in the standard error of the mean). Thus, De Wolff and van IJzendoorn (1997), for example, in their meta-analysis of maternal sensitivity and attachment security studies, found that effect size was inversely related to sample size. The squared deviation of the effect size from its estimate (the basis of a least squares regression model) ought, therefore, to be proportional to the number of subjects.

So, the regression involved the following steps. First, the estimate of the value of effect size with no delay between the predictor variable and attachment security was computed separately (as the mean of all observed concurrent effect sizes). Second, this mean was entered as a constant in the estimate of an inverse function estimating effect size as a function of delay between measures. Third, the contribution of each effect size to the sum of squared deviations between estimate and observation was set to be proportional to the number of subjects in the estimate of effect size.

RESULTS

Social–Marital Support

Table 1 presents the studies of social–marital support and attachment security. Figure 1 shows the distribution of effect sizes. The mean weighted effect size is .14 ($SD = .20$, 95% CI = −.13 to .41; $z = 4.24$, $p < .0001$). Thirty studies (1.76 times the number of findings represented here) averaging null results would be needed to reduce the effect size to just significant. Effect sizes are heterogeneous, $\chi^2(16) = 34.82$, $p < .005$, but neither cluster analysis nor nonparametric statistics indicated where the differ-

ences might lie when *p*-values were set at conventional levels. However, it is worth noting, for heuristic reasons, that the analysis was significant with α set at .10. Two clusters were extracted, one consisting of the Nakagawa et al. (1992) effect size ($r = -.31$), the other including all other effect sizes (see Figure 1). Having excluded the Nakagawa et al. study because of its possibly outlying status, we also found that the difference between the effect sizes derived from studies based on inventory assessment of social support ($k = 11$, $N = 490$, $M = .15$, $SD = .16$) may be smaller than those computed for studies using alternative assessment techniques (interview, intervention; $k = 3$, $N = 148$, $M = .35$, $SD = .12$; $z = 1.71$, $p < .10$). Although we analyzed effect sizes according to year of publication, child age at attachment assessment, time between social support and attachment assessments, attachment measure (Strange Situation vs. Attachment Q-set), coding scheme (ABC vs. ABCD), and environmental risk status, we found no further differences.

Stress

Table 2 presents the studies of maternal stress and attachment security. Figure 2 provides the distribution of effect sizes. The mean *r*, weighted by sample size, is a significant .19 ($z = 5.41$, $p < .0001$, $SD = .17$, 95% CI = .07 to .31), with 42 studies (i.e., 3 times the number of findings represented in this meta-analysis) averaging null findings required to reduce this *p*-value to the just significant level.

The test for heterogeneity was not significant. However, the effect size linking maternal stress and attachment security is negatively correlated with the time span separating these evaluations ($\rho = -.63$, $p < .05$). To further explore this finding in relation to the effect size linking maternal stress and attachment security ($r = .19$), we conducted the regression analysis previously described. The estimated parameter was significantly different from 0.0, $t = 2.55$, $p < .05$, two-tailed. The estimated effect sizes derived from this analysis are graphed in Figure 3. The plot shows a steep diminution

Stem	Leaf
.4	344
.3	03
.2	9
.1	024569
.0	0379
-.0	
-.1	2
-.2	
-.3	1

FIGURE 1. Mean social support effect sizes (rs) per sample.

TABLE 1. Description of Studies Examining Maternal Social Support and Attachment Security

Study	Social Support Measure	*N*	Attachment Assessment Age (Months)
Barnard et al., 1988	Personal Resources Questionnaire	81[a,b]	13 & 20
Barnes, 1989[4]	DAS	68[c]	12–15
Benn, 1986	Rating scale of satisfaction with husband's participation in child-rearing	30[d]	19
Crnic, Greenberg, & Slough, 1986[2]	Henderson support scales: Total Intimate Friendship & Community	36[j,k]	12
Crockenberg, 1981	Social Support Interview	48[c]	12
Durrett, Otaki, & Richards, 1984	Taylor Inventory	34[l]	12
Egeland & Farber, 1984	Living Arrangement/Relationship	147[a]	12 & 18
Howes & Markman, 1989[1]	Maternal Perception of Marital Quality: Marital Adjustment Test Relationship Problem Inventory Communication Box Ratings	20[c]	20 (*M*)
Isabellsa, 1994	Marital Satisfaction Scale Four factor scale of intimate relations Social network interview	32[c]	12
Jacobson & Frye, 1991[1,3]	Experimental Manipulation	46[a]	14
Manassis, Bradley, Goldberg, Hood, & Price-Swinson, 1994	Marital Adjustment Questionnaire	18[h]	36 (*M*)
Murray, 1992	Social Adjustment Scale	104[e,f,g]	18
Nakagawa, Teti, & Lamb, 1992[1]	Composite score: ISIQ, MHS, 5 items of DAS	51[l]	33
Poehlmann, 1995[4]	Contact and satisfaction with maternal grandmother's support, IPE	39[c] 34[k]	12 12
Spieker & Booth, 1988[2]	SSPIQ, PRQ	60[a]	13
Ward, Kessler, & Altman, 1993	Standardized interview	54[i]	17

Note. DAS = Dyadic Adjustment Scale; ISIQ = Interview for Social Interaction Questionnaire (availability of attachment and adequacy of attachment subscales); MHS = Marital Harmony Scale; PRQ = Personal Resources Questionnaire: SSPIQ = Social Support and Partner Involvement Questionnaire; IPE = Inventory of Parent's Experiences; *M* = Mean sample size, used when effect sizes were derived from multiple analyses, some of which involved missing data.

Number superscripts denote study descriptors. Letter superscripts denote sample descriptors. Attachment measured by Strange Situation unless otherwise specified.

[1]Attachment measured by Q-Set, [2]Attachment measured by modified Strange Situation, [3]Social support intervention, [4]Doctoral thesis.

[a]Environmental "high risk" mothers, [b]Mothers with low social support, [c]Community sample, [d]All mothers employed, [e]Postpartum depression with no depressive history + control group, [f]Postpartum depression with depressive history + control group, [g]Depressive history with no postpartum depression + control group, [h]Maternal anxiety disorder, [i]Failure-to-thrive + control sample, [j]Low birthweight infants, [k]Preterm infants, [l]Japanese sample.

TABLE 2. Description of Studies Examining Maternal Stress and Attachment Security

Study	Stress Measure	*N*	Attachment Assessment Age (Months)
Atkinson et al., 1999[3]	Profile of Mood States, tension subscale	43	16 & 22 (MA)
Hellstrom, 1994[1]	PSI	36[c]	36
Jacobson & Frye, 1991[1]	Life Events Scale	46[a]	14
Manassis, Bradley, Goldberg, Hood, & Price-Swinson, 1994	PSI Life Experiences Survey	20[f]	36.3 (*M*)
Michels, 1992[4]	PSI	65[c]	18
Nakagawa, Teti, & Lamb, 1992[1]	Kansai-Gakuin PSI	52[i]	33
Pederson, Moran, Sitko, Campbell, Ghesquire, & Acton, 1990[1]	PSI	40[c]	12[a]
Phillips, 1990[4]	Life Experiences Inventory	36[d]	16
Spieker & Booth, 1988[2]	DLCS Life Experiences Survey	60[a]	13
Tarabulsy, Moran, Pederson Tessier, & Gagnon, 1995	PLCI	67[c] 68[h]	13.71 (*M*) 12
Teti, Gelfand, Messinger, & Isabella, 1995	PSI	50[e]	16–21
Vaughn, Egeland, Sroufe, & Waters, 1979	SLEI	100[a,b]	18
Ward, Kessler, & Altman, 1993	Life Events Inventory	54[g]	17

Notes. DLCS = Difficult Life Circumstances Scale; SLEI = Stress Life Events Inventory; PSI = Parenting Stess Index; PLCI = Problematic Life Circumstances Index; MA = Mental Age; *M* = Mean sample size, used when effect sizes were derived from multiple analyses, some of which involved missing data.

Number superscripts denote study descriptors. Letter superscripts denote sample descriptors. Attachment measured by Strange Situation unless otherwise specified.

[1]Attachment measured by Q-Set, [2]Attachment measured by modified Strange Situation, [3]Atachment measured by both Strange Situation and Attachment Q-set, [4]Doctoral thesis.

[a]Environmental "high risk" mothers, [b]Adolescent mothers, [c]Community sample, [d]All mothers employed, [e]Depressed + control group, [f]Maternal anxiety disorder, [g]Failure-to-thrive + control sample, [h]Preterm infants, [i]Japanese sample.

of estimated effect size as one moves from concurrent to near-concurrent designs, with an eventual levelling off at small effect size when the time between assessments of maternal stress and attachment security is relatively lengthy.

Our expectation that parenting stress ($k = 6$, $N = 263$, $M = .30$, $SD = .16$) would be more strongly related to attachment security than life-event stress ($k = 7$, $N = 431$, $M = .16$, $SD = .16$) was not confirmed ($z = 1.36$, $p = .17$), perhaps because of the small number of studies involved. Several other factors did not relate significantly to effect size: publication status, year of publication, age of child at attachment measure, attachment measure (Strange Situation vs. Attachment Q-set), clinical status (psychiatric vs. nonpsychiatric), environmental risk status, and classification scheme (ABC vs. ABCD).

Stem	Leaf
.5	0
.4	5
.3	2
.2	044556
.1	05
.0	08
-.0	6
-.1	7

FIGURE 2. Mean maternal stress effect sizes (rs) per sample.

Depression

Table 3 summarizes studies linking maternal depression and attachment security. Figure 4 shows the effect size distribution. The mean weighted effect size is .18 (SD = .16, 95% CI = −.02 to .37). This effect size is significant, (z = 5.79, $p < .0001$, with 49 null findings (i.e., 2.58 times the number of findings included in this meta-analysis) needed to reduce it to the just significant level. The estimates were heterogeneous, $\chi^2(16) = 29.84$, $p < .05$. A disjoint cluster analysis did not reveal a source of variation. However, effect sizes were significantly higher in studies that either measured depression in clinical samples or compared clinical samples to nonclinical samples (k = 9, N = 428, M = .27, SD = .18) than they were in studies that measured depression in nonclinical samples (k = 10, N = 609, M = .09, SD = .09), z = 2, $p < .05$. Of further interest, even within the subset of clinical samples, effect sizes were significantly heterogeneous, $\chi^2(8) = 16.48$, $p < .05$. In the sample as a whole, and contrary to expectation, effect sizes were not significantly higher for studies that employed the ABCD coding scheme as opposed to ABC. Nor did we find significant associations between effect

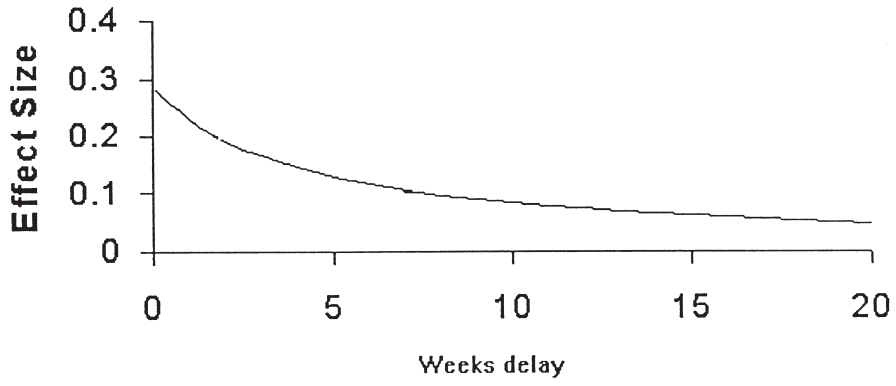

FIGURE 3. Effect size (r) by delay between stress and attachment assessments.

TABLE 3. Description of Studies Examining Maternal Depression and Attachment Security

Study	Depression Measure	*N*	Attachment Assessment Age (Months)
Atkinson et al., 1999[2]	Beck Depression Inventory POMS-D	36[m] (*M*)	16 & 22 (MA)
Barnard et al., 1988	Beck Depression Inventory	78[c] (*M*)	13 & 20
D'Angelo, 1986	DSM-III	30[e]	12.5 (*M*)
Dawson, Klinger, Panagiotides, Spieker, & Frye, 1992	CES-D	26[a,b]	14.2 (*M*)
Del Carmen, Pederson, Huffman, & Bryan, 1993	Beck Depression Inventory	52[d]	12–13
Donaldson, 1992[3]	MMPI-2 Scale "D" CES-D	124[a] (*M*)	13 & 19
Donovan & Leavitt, 1989	Beck Depression Inventory	40[d]	15.8 (*M*)
Goldberg et al., 1997	Beck Depression Inventory Edinburgh Postnatal Depression Scale	80[d]	12
Lyons-Ruth, Connell, & Grunebaum, 1990	CES-D	70[a]	18
Manassis, Bradley, Goldberg, Hood, & Price-Swinson, 1994	Beck Depression Inventory	20[l]	36 (*M*)
Murray, 1992	Edinburgh Postnatal Depression Scale Standard Psychiatric Interview SADS	73[i] 48[k] 59[j]	18
Radke-Yarrow et al., 1985[1]	SADS	43[h]	31 (*M*)
Radke-Yarrow et al., 1995[1]	SADS	56[g] 71[f] 32[h]	31 (*M*)
Spieker & Booth, 1988[1]	Beck Depression Inventory	60[a]	13
Teti, Gelfand, Messinger, & Isabella, 1995	DSM-III-R Beck Depression Inventory	50[e]	16–21

Notes. MMPI-2 = Minnesota Multiphasic Personality Inventory, 2nd ed; CES-D = Center for Epidemiological Studies-Depression Scale; SADS = Schedule for Affective Disorders and Schizophrenia; DSM-III = Diagnostic and Statistical Manual of Mental Disorders, 3rd ed.; POMS-D = Profile of Mood States-Depression Scale; MA = Mental Age; *M* = Mean sample size, used when effect sizes were derived from multiple analyses, some of which involved missing data.
Number superscripts denote study descriptors. Letter superscripts denote sample descriptors.
Attachment measured by Strange Situation unless otherwise specified.
[1]Attachment measured by modified Strange Situation, [2]Attachment measured by Strange Situation and Q-set, [3]Doctoral thesis.
[a]Environmental "high risk" mothers, [b]Adolescent mothers, [c]Mothers with low social support, [d]Community sample, [e]Depressed + control group, [f]Unipolar depression + control group, [g]Bipolar depressive disorder + control group, [h]Minor depression + control group, [i]Postpartum depression with no depressive history + control group, [j]Postpartum depression with depressive history + control group, [k]Depressive history with no postpartum depression + control group, [l]Maternal anxiety disorder, [m]Developmentally delayed infants.

Stem	Leaf
.5	08
.4	13
.3	157
.2	6
.1	000356
.0	17
-.0	267

FIGURE 4. Mean depression effect sizes per sample.

size and publication status, year of publication, attachment measure (Strange Situation vs. modified Strange Situation), time between depression and attachment assessments, and age of child at security assessment.

DISCUSSION

It is difficult to put effect sizes into perspective. Cohen (1988) suggested $r = .10$, .30, and .50 as weak, medium, and strong, respectively. But De Wolff and van IJzendoorn (1997) pointed out that the .24 effect size they found linking maternal sensitivity to attachment security means that mothers who are sensitively responsive improve the probability of their child's being securely attached from 38% to 62%, a substantial increase. Moreover, the .24 effect size compares favorably to effect sizes of .03 and .04 (linking propranolol and aspirin, respectively, to reduced heart failure) that have changed the practice of medicine (De Wolff & van IJzendoorn, 1997). On the other hand, the effect sizes link widely used psychological instruments such as the Rorschach, Minnesota Multiphasic Personality Inventory, and Wechsler Adult Intelligence Scales to outcome variables of interest corresponding to .41, .46, and .62, respectively (Parker, Hunsley, & Hanson, 1988). The effect size linking maternal Adult Attachment Interviews to infant attachment security is .50 (van IJzendoorn, 1995). The focus of the following discussion is not so much on the absolute value of the effect sizes found here, but on their comparative values and on how we might better evaluate the relation between the distal variables in question and attachment security.

Social–Marital Support

The mean effect size relating maternal social support–marital satisfaction to attachment security was a significant .14, confirming long-held beliefs linking these two constructs. Effect sizes were significantly heterogeneous, and included significantly positive and significantly negative coefficients. We examined a variety of variables in an effort to explain this variation, but found no significant discriminators. A cluster analysis, significant only at the .10 level, suggested that the association reported by Nakagawa et al. (1992) of −.31 might be different from those found by other investigators

(Figure 4). Also, a comparison of studies that relied on inventory-based assessment of social–marital support suggested that they may ($p < .10$) produce smaller effect sizes than studies utilizing alternative assessment strategies.

Consistent with expectations, the near significant difference between inventory-based effect sizes ($M = .15$) and effect sizes that were derived from alternate methods (i.e., intervention and interview; $M = .35$) suggests that the heavy reliance on self-report measures may have constrained effect sizes artificially. For example, the most widely used (Budd & Heilman, 1992; Stuart, 1992) marital support inventory, the Dyadic Adjustment Scale (DAS; Spanier, 1989) has been criticized for its atheoretical approach to marital satisfaction (Norton, 1983; Stuart, 1992), its restricted standardization sample (Budd & Heilman, 1992; Stuart, 1992), and the misleading psychometric procedures utilized in item selection (Norton, 1983).

Norton (1983) suggested that DAS items are indiscriminately weighted, such that similarly endorsed items (e.g., religious and sexual compatibility) contribute equally to a composite score, although they may not be phenomenologically equivalent to the couple in question. Moreover, some areas of satisfaction are more broadly sampled than others. For example, 15 items pertinent to mutual agreement are included in the DAS, and four items relevant to affection (Norton, 1983). But these aspects of marital support may differentially influence mother–child attachment security, perhaps depending on age of the child. Another aspect of the spousal relationship that might be relevant, from an attachment point of view, is trust or security of attachment vis-a-vis the husband, but no items of the DAS reflect this phenomenon. Future research needs a stronger theoretical base, with recognition that attachment theory may be as relevant to the measure of interpersonal predictors as it is to the assessment of attachment outcomes.

The possibly anomalous findings of Nakagawa et al. (1992), based on the wives and children of Japanese executives visiting the United States, may illustrate the importance of moving beyond inventory-based assessment. Having gone to great lengths to ensure the cross-cultural validity of their social–marital support inventories, Nakagawa et al. (1992) found that the lower the reported satisfaction of the mothers with their support, the more secure their children appeared. Nakagawa et al. (1992) ventured that these mothers had developed compensatory relationships, seeking closeness from their children that they could not obtain through marriage. Nakagawa et al. (1992) argued that this may reflect the Japanese emphasis on the working role of the father and strong, interdependent mother–child bonds. However, in a meta-analysis of 68 studies, Erel and Burman (1995) found "clear support" for the hypothesis that unsatisfactory marital relations adversely affect the parent–child relationship (the "spillover" effect) and a "clear lack of support" for the hypothesis that poor marital relations improve parent–child relations (the compensatory hypothesis; p. 127). The findings of Erel and Burman (1995) do not preclude the explanation of Nakagawa et al. (1992) entirely, given the cross-cultural nature of the sample in question, but they do suggest the need to augment inventory-based assessment with interview and other techniques that might prove more phenomenologically relevant to mothers.

Stress

Measurement. The mean effect size relating maternal stress to attachment security was a significant .19, validating hypotheses regarding the association between these two constructs. However, the exclusive reliance on self-report inventories in the measure-

ment of stress may have resulted in an underestimate of the strength of the link between maternal stress and attachment security. In comparing interview and self-report technologies, Costello and Devins (1988) discovered that a severe life event had occurred in only 27% of instances in which respondents endorsed the relevant item. Furthermore, self-report questionnaires include diverse events, most of which are acute and mildly to moderately stressful rather than chronic and extreme. Evaluation with these inventories results in ambiguity where high scores are concerned, such that a number of less severe events may yield a greater score than a single extreme, chronic stressor (for review see Coyne & Whiffen, 1995). It is the latter stressors, however, that potentially threaten family well-being and, consequently, are of greatest relevance to attachment theorists (Benn, 1986).

Furthermore, the inventories adopted are generic, acontextual measures of stress. Recommending that investigators supplement life-event stress inventories, Coyne and Whiffen (1995) instantiated, "interviewing can . . . determine whether 'birth of a child' represents a planned positive experience or a threatening one, such as a source of increased dependence on an abusive partner whom the woman would otherwise have left" (pp. 368–369). Gresham (1989) implied the same criticism with respect to parenting stress; child behaviors and temperament are measured as if they were synonymous with parenting stress rather than possible contributors of varying influence. Future research must measure maternal stress using more phenomenologically sensitive instrumentation.

Stability. Effect sizes correlated with the time span separating stress and attachment assessments ($\rho = -.63$); the greater the time between assessments, the weaker the effect size. Although this finding is based on only 15 studies, a similar relation emerged from meta-analyses of maternal sensitivity and attachment security. Goldsmith and Alansky (1987) found a correlation of $-.47$ between effect size and time separating sensitivity and attachment assessments; De Wolff and van IJzendoorn (1997) reported an association of $z = 2.69$ (which translates into $r = -.49$; Mullen, 1989), and Atkinson et al. (in press) found a correlation of $-.39$. Time span between assessment of the predictor and assessment of attachment security attenuates the link between them.

The magnitude of this attenuation is difficult to judge, however, because the effect size linking stress (in this case) and security (.19) is based on a different metric from the correlation between time and the effect size itself ($-.63$). For this reason, we conducted a nonlinear regression analysis; the regression line is plotted in Figure 3. The plot shows a rapid diminution in effect size as one moves from concurrent to longitudinal data, with a levelling off as the time between stress and attachment assessments increases. Of course, one must be careful in interpreting this figure. The effect sizes upon which it is based are confounded by parameters other than those entered into the regression (e.g., restriction of range). Furthermore, the regression itself is founded on only 15 studies. It may be safest to regard this plot as descriptive of the sample rather than the population. Nevertheless, the plot does afford a more textural idea of the magnitude and shape of change inherent in $\rho = -.63$. Furthermore, the general shape of the plot is consistent with the analogous figure representing effect size change in a sample of 38 sensitivity studies (Atkinson et al., in press).

One interpretation of these data is that they are concordant with the theory that attachment security and, by implication, internal working models are flexible and reality-based; they change with changes in maternal state (Bowlby, 1969). However, the magnitude of the correlation involved ($\rho = -.63$) and the rapid diminution of effect

size that comes with nonconcurrent research designs merits scrutiny. In combination with similar findings in meta-analyses of maternal sensitivity and attachment security (Atkinson et al., in press; De Wolff & van IJzendoorn, 1997; Goldsmith & Alansky, 1987), the present data raise the issue of just how flexible early working models are. To what extent is the stability of attachment security, in so far as it exists (Belsky, Campbell, Cohn, & Moore, 1996; Goldberg, Grusec, & Jenkins, 1997), a product of conservative working models and to what degree does it reflect environmental stability? If attachment security is so dependent on environmental circumstances, then how much explanatory power does the construct of internal working models afford above and beyond environmental contingencies, at least in the early years? Do early measures of attachment, such as the Strange Situation, truly conceptualize an extensive history of mother–child relations, or do they reflect the continuation of relatively recent interactions (and stable long-term interactions) between mother and child? As Kobak (1994) noted, "Nearly all findings with the attachment styles could be interpreted as the product of the current relationship patterns rather than any stable personality contribution" (p. 43). We are not suggesting that the concept of environmental stability replace that of internal working model. One further possibility, for instance, is that internal working models and environmental circumstances interact, such that each influences the stability of the other. However, the current data underscore that the existence of internal working models has been assumed, rarely demonstrated (cf. Egeland & Carson, 1998). There is a need to study the environmental correlates of stability and change in attachment security (Egeland & Farber, 1984; Vaughn et al., 1979), rather than just the correlates of attachment security itself.

Depression

The effect size linking depression and security was a significant .18, verifying the hypothesis that these constructs are related. However, the effect size distribution was heterogeneous, with nonclinical samples showing a .09 link between distress and security and clinical samples showing a .27 effect size. We will discuss this discrepancy in terms of sampling issues (i.e., differences in quality, quantity, and stability of depressed mood) and measurement considerations.

Possibly explaining the effect size difference in clinical and community samples, Coyne (1994; Coyne & Gotlib, 1983) argued that clinical and nonclinical samples imply distinct definitions of depression. Fewer than a third of community participants who exceed cut-off on self-report depression inventories meet Diagnostic Statistical Manual (DSM; American Psychiatric Association, 1994) criteria for major depression; individuals in high-scoring community samples do not report anhedonia and are not broadly impaired. Furthermore, the mean scores of high-scoring community samples are lower than the mean scores of clinically depressed samples. Coyne (1994) referred to high scoring individuals from community samples as distressed rather than depressed. The processes linking maternal mood and attachment security may be qualitatively and quantitatively different in clinical and community samples.

Furthermore, the stability of mood state may be important to the prediction of child attachment security. Psychiatric outpatients who meet criteria for depression are likely to be experiencing an episode of 6 to 9 months or longer. Over half these individuals experience a relapse within 2 years, and, after first onset, they spend a mean of 20% of their lifetime in a depressive episode (Coyne, 1994). Moreover, although clinically depressed individuals suffer distinct episodes of depression, they also experi-

ence residual dysfunction between episodes. Radke-Yarrow et al. (1995) summarized: "Empirical studies . . . have found behavioral continuities from episodes to nonepisodes, although symptoms vary in severity. We assume, therefore, that depressed mothers present a history of interaction with their children that has an underlying dispositional theme" (p. 250).

By contrast, the distress of individuals in high-scoring community samples is often more transitory. Several investigators report that college participants who score above cut-off change classification within weeks, days, or hours (for review see Coyne, 1994). The comparative stabilities of clinical and self-reported depression may explain the differential effect sizes linking these constructs to attachment. This interpretation is consistent with the finding that maternal sensitivity more powerfully predicts attachment security when these two constructs are measured in close temporal proximity than when the time span separating their assessment is longer (Atkinson et al., in press; De Wolff & van IJzendoorn, 1997; Goldsmith & Alansky, 1987). We made the same finding with respect to maternal stress and attachment security (discussed previously). De Wolff and van IJzendoorn (1997) suggested that, "Sensitivity may be an important condition of attachment security only when it remains stable across time" (p. 586). The same interpretation may apply to depression.

Measurement issues also may account for the discrepant effect sizes when studies involving clinical samples are compared to studies relying solely on community samples. Typically, clinical samples are identified on the basis of diagnostic interview, whereas community-based studies involve self-report measures. However, investigators (Field et al., 1991; Lyons-Ruth, Zoll, Connell, & Grunebaum, 1986) have shown that mothers who score 0 on self-report measures may be as distressed as mothers who score above cut-off. Field et al. (1991) demonstrated further that this malaise may be evinced by mothers and babies in their mutual interaction. When mothers from one end of the scale place themselves at the other end, as in this instance, the attenuation of the correlation linking the constructs under consideration could be substantial.

With reference to clinical samples, the .27 effect size indicates that maternal depression operates as a serious risk factor, but it is far from deterministic. Perhaps, as a feature of maternal personality rather than mother-child interaction, the effects of depression are moderated by other personal, interpersonal, and environmental factors, as might be predicted with the model of proximal and distal influences by Belsky (1984; Belsky et al., 1995a). This consideration applies to all constructs measured here, of course, and speaks to a weakness of this meta-analysis—we examine the effects of social–marital support, stress, and depression separately, thereby neglecting their cumulative impact and mutually moderating effects (see Radke-Yarrow et al., 1995).

However, the picture that emerges from this meta-analysis is more complicated than our discussion of clinical versus nonclinical samples would suggest. Even within clinical samples, the effect sizes linking maternal depression and attachment security are significantly heterogeneous. For example, the highest effect size within the clinical samples ($r = .58$; Mannassis et al., 1994) was derived from a group of mothers who met DSM criteria for anxiety disorder and who self-reported on depression. The smallest effect size ($r = -.02$; Zelkowitz & Milet, 1998) was based on a sample of mothers diagnosed with postpartum depression. The reasons for such discrepancies are presumably many, perhaps comorbidity in the former case, issues of stability with reference to depression and its correlates in the second. At the level of primary studies, the heterogeneity of effect sizes is well reflected in the work of Radke-Yarrow et al. (1995).

Radke-Yarrow et al. (1995) found that maternal bipolar depression was associated with increased rates of insecurity (63% insecure). However, only 41% of mothers with unipolar depression had insecure infants, comparable to the 38% of mothers in the nondepressed control sample. Again, there is substantial variability in the impact of depression on child attachment security.

Findings such as these indicate that the constructs of depression and clinical depression are too broad for the sensitive prediction of attachment security. More powerful prediction requires that we take into account factors beyond depression (such as those previously discussed, e.g., parental accessibility, mood states, and genetics) and beyond a single caregiver (e.g., concurrent assessment of both parents might suggest that fathers and father–mother interaction serve to moderate the effects of depression). In this regard, Radke-Yarrow et al. (1995) found that stressor contexts within the family are interrelated. They reported, for example, that maternal diagnosis was related to recent losses, marital discord, and disturbed interpersonal relationships. Radke-Yarrow et al. (1995) concluded:

> This high overlap of stressful conditions not only underscores the likelihood of "third" variables operating in investigations in which a single variable or condition is considered in relation to child behavior, but also illustrates the difficulties in identifying specific critical underlying mechanisms when multiple interacting contributors are involved. (p. 255)

We need to move beyond main effects models in the prediction of attachment security, to contextualized (De Wolff & van IJzendoorn, 1997) interactional and transactional (Belsky, 1997; Schneider Rosen & Rothbaum, 1993) conceptualizations.

Thus far in our discussion, we have focused on effect sizes. This should not obscure the fact that when depression does influence child security, it may do so with vehemence. Radke-Yarrow et al. (1995) found that almost twice the percentage of severely ill parents (29%) had children with some form of disorganized attachment (considered a potentially pathological form of attachment) than was the case for control mothers (15%).[5] Murray (1992) and Teti et al. (1995) also reported a disproportionate number of disorganized attachments among the children of mothers with depression. These data indicate that clinical depression may influence not only the probability of insecure attachment, but also its profundity.[6]

Several features and correlates of maternal depression (e.g., parental unresponsiveness, mood fluctuation, and genetic influences, as discussed in the introduction) could explain its impact on child attachment security. Future research might focus on how these factors exert their influence, perhaps through comparison of mothers with different types of clinical depression. Longitudinal work, following parent–child relations as mother moves in and out of depressive episodes, and intervention studies also

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[5]Even here, though, the discrepancy among types of depression was great: 21 % of mothers with unipolar depression had children classified disorganized, compared to 42% of mothers with bipolar depression.

[6]In a post hoc analysis, we compared the number of D classifications among low risk community samples ($k = 8$, $N = 289$; 16% D), high-risk community samples ($k = 2$, $N = 70$; 34% D), and clinical samples ($k = 6$, $N = 144$; 29% D). An overall χ^2 proved significant, $\chi^2(2) = 15.71$, $p < .001$. Follow-up χ^2s revealed significant differences between low-risk community samples and clinical samples ($\chi^2 = 9.03$, $p < .01$) and between low-risk and high-risk community samples ($\chi^2 = 10.43$, $p < .01$). The difference between high-risk and clinical samples was not significant ($\chi^2 = .36$).

would be useful in this regard. Such research might help disentangle the possibly transactional association between maternal depression and child attachment insecurity (Cohn, Campbell, Matias, & Hopkins, 1990; Dodge, 1990; Hammen, Burge, & Stansbury, 1990).

Summary

We draw four broad conclusions from these analyses.

1. Maternal social support, marital satisfaction, stress, and depression are significantly related to attachment security.
2. The strength of the association between each of the maternal mental health variables and attachment security varies according to how the mental health construct is defined, and how, when and in what context it is measured.
3. Most investigators assessed social–marital support, stress, and depression using self-report inventories. Given the psychometric limitations of such an approach (in terms of validity, stability, and contextual relevance), further exploration of these constructs, using alternative measurement approaches, would be informative.
4. The effect sizes linking maternal stress (and sensitivity) to attachment security vary significantly and substantially according to the time span separating their measurement. This association reminds us of the need to scrutinize stability and change in attachment security, with a view to more exact theorizing about the conservatism and flexibility of internal working models.

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