

Maternal Unresponsiveness and Infant Crying Across the First 9 Months: A Naturalistic Longitudinal Study

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In this longitudinal study of 50 mother-infant dyads, it is hypothesized that maternal responsiveness, defined as promptness of maternal interventions to infant crying, decreases the number and duration of infant crying bouts. All subjects were visited 12 times at home at 3-week intervals during the first 9 months after the birth of the infant. The mean total observation period for every dyad was 21.7 hours. Data on frequency and duration of infant crying and maternal responsiveness were collected through event- and audiorecording equipment. Results show that average duration of crying is reduced by half from the first to the third quarter. Average frequency of crying bouts, however, remains the same. Individual differences in duration of crying cannot be explained by differences in promptness of maternal responsiveness to infant crying. However, individual differences in number of crying bouts at the end of the first half year can be partly attributed to differences in maternal responsiveness. More frequent delay of maternal responses reduces the number of crying bouts during the first half year of life. The concept of differential responsiveness is hypothesized to explain our unexpected results.

crying	maternal responsiveness	longitudinal
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Infant crying is one of the most provocative behaviors in the first year of life, evoking strong emotions from the caregivers. Excessive crying has been identified as one of the main proximate causes of child abuse and neglect.

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(Frodi, 1985). Caregivers aim at control and restriction of crying, but the question of which caregiving style is most effective in preventing or reducing crying has not yet been answered (Lester, 1985). Maternal responsiveness defined as promptness of response to infant crying is supposed to be one of the main determinants of individual differences in development of crying in normal populations (Bell & Ainsworth, 1972). If crying is considered to be pre-attachment behavior, directed towards the goal of proximity to the protective caregiver, reaching that goal may be sufficient cause to terminate the crying behavior (Bell & Ainsworth, 1972).

Few naturalistic studies on the relation between maternal unresponsiveness and infant crying across the first year of life have been carried out to describe the development of infant crying (Barr, 1989) and to test the hypothesis that prompt responses do indeed decrease the number and duration of infant crying bouts. Bell and Ainsworth's (1972) ecologically impressive and pioneering longitudinal study was only intended to explore the idea that crying behavior would be reduced by prompt interventions from the caregiver, and every pretension to settle the issue for good was explicitly discarded (Ainsworth & Bell, 1977). In observing 26 mother-infant dyads at regular intervals at home, and writing narrative accounts in which frequency and duration of all cry episodes and corresponding maternal responses were described, Bell and Ainsworth were able to present some evidence in favor of the hypothesis that longer crying corresponds to a longer delay of maternal interventions within and across the four quarters of the first year of life. They found that the quality or type of maternal intervention was much less important than its promptness; they concluded that "the single most important factor associated with a decrease in frequency and duration of crying throughout the first year is the promptness with which a mother responds to cries" (p. 1183).

Although several authors commented critically on the study's design and statistical analyses (Gewirtz & Boyd, 1977a; Lamb, Thompson, Gardner, & Charnov, 1985), its results were claimed at least partly to be supported by the studies of Belsky, Rovine, and Taylor (1984), Crockenberg and Smith (1982; Crockenberg & McCluskey, 1986), and Grossmann, Grossmann, Spangler, Suess, and Unzner (1985). These studies, however, addressed the issue of the relation between infant crying and maternal responsiveness only as a sideline to other research goals and did not use promptness of interventions as the main indicator of maternal responsiveness. For example, Belsky et al. constructed a measure for reciprocal interaction containing responses not only to crying but also to other infant behaviors; Crockenberg and Smith used an attitude scale for responsiveness; and Grossmann et al. applied a rating scale in which, specifically, appropriateness of maternal interventions was operationalized. In fact, the operationalizations of responsiveness used by Belsky et al., Crockenberg and Smith, and Grossmann et al. appear to imply the

concept of "differential responsiveness," in which the appropriateness of the response to mild or severe distress is emphasized (Hubbard & van IJzendoorn, 1987). The original question, whether promptness of response would be sufficient to decrease infant crying, however, remained unanswered.

Our study is intended to address this question in a confirmatory way, using a naturalistic longitudinal design in which maternal responsiveness is operationalized in terms of promptness of interventions. The study is designed to describe the development of frequency and duration of infant crying during the first 9 months of the infants' lives and to test the hypothesis that maternal responsiveness, defined as promptness of maternal interventions, does indeed decrease the number and duration of infant cry bouts.

METHOD

Subjects

Given the limitations imposed by the restricted availability of four technical equipment sets (event recorder/FM audio registration unit), we were obliged to collect data from late summer 1983 to late summer 1984 for the first part of the sample ($N = 28$; a preliminary report on the first part of the study can be found in Hubbard and van IJzendoorn, 1987) and from fall 1986 to fall 1987 for the second part of the sample ($N = 25$). Due to the malfunctioning of technical equipment, three dyads had to be removed from our sample ($N = 50$). The sample consisted of original Dutch (i.e., nonimmigrant) families living either in, or in the neighborhood of, two Dutch cities, The Hague and Leiden. Eighty percent of the families were located through midwives (private practice), and 20% through city hall. All infants were normal, healthy, full-term deliveries (with the exception of one caesarian delivery). All infants' participation in our study started during the 3rd week after birth and finished during their 36th week after birth. Twenty-six of the infants were boys; 24 were girls; 27 were firstborn; 23 were second-born. The mean educational level for the mothers was 5.3 ($SD = 2.4$) on a scale ranging from 1 (6 years of schooling) to 9 (16 years of schooling). The mean educational level of the fathers was 5.7 ($SD = 2.5$). The sample could be described as representative of young, lower- to middle-class families with two parents in which parental roles were traditionally allocated between spouses.

Procedure

All subjects were visited 12 times at home at 3-week intervals during the first 9 months. The hypotheses of the study were not revealed to the mothers. The observers were expecting the study to confirm the hypothesis that earlier maternal unresponsiveness would lead to more infant crying later on (Bell & Ainsworth, 1972). Because the outcome of the study does not confirm this

hypothesis, contamination of data collection by the observers' knowledge of the hypothesis seems to be negligible. Visits were scheduled at the mother's convenience, the only restriction being that morning, afternoon, and evening observations were needed (unfixed order) to get a representative sample of the infant's crying behavior. Mother-infant pairs were visited regularly by one female observer, except for an occasional joint visit made by two observers for reliability checks. The last five visits to seven families were made by the first author. Visits lasted for 2 hours (first quarter) to 4 hours or more (third quarter). Observers planned to arrive half an hour before the infant awoke (as determined by the mother's expectations) to install the technical equipment in a stand-by operating mode. Usually there was ample opportunity for interviews after the observation period. The observation period started when the infant awoke and finished when the infant fell asleep (or after 3 hours if the infant was awake longer). During the observation period, the observer was obliged to play a low-profile, semiparticipant role so as to be able to attend continuously to the ongoing stream of behavior recorded on the event recorder. For each quarter, data of four successive observation periods were used to compute measures. The mean total observation period for the first quarter was 5.8 hours ($SD = 1.6$), for the second quarter, 7.1 hours ($SD = 1.9$), and for the third quarter, 8.8 hours ($SD = 2.1$). An event recorder (Epson HX 20 portable minicomputer operating on batteries) was used to code the mother-infant interactions continuously. Because we are focussing here only on promptness of interventions, regardless of type of intervention—as did Bell and Ainsworth (1972)—the coding system will not be described in detail (see Hubbard, 1989).

During the observation period, vocalizations of the infant and the mother (if she was in the same room) were recorded with an audio-registration unit. This unit contained three components: (a) a wireless FM-transmitter/microphone combination (type Sennheiser SK 1012 [MKE 2012]), (b) a Uher report 4400 portable stereo tape recorder, and (c) an FM receiver (type Sennheiser/Telefunken EM 1008). In order to synchronize the event recorder and the audio-registration unit on a time-reference axis, a time-code generator was used to write the time (coded by tone pulses) on track 1 of the tape recorder. The vocalizations of the infant and mother were recorded on track 2. At the beginning of the visit, the time-code generator was connected to the event recorder in order to synchronize the two internal clocks. The audio-registration unit was placed in the living room, out of sight of the mother. The FM transmitter/microphone combination was always placed in the room where the infant was. The observer could check in the living room through her earphones if the infant was awake. When the infant awoke, the unit was started and could operate for 90 min before the tape needed changing. In the meantime, the observer was able to code the interactions of mother and infant by means of the portable event recorder. The technical equipment was chosen to enhance the reliability and validity of the data. It could register

the infant crying under all circumstances without being intrusive. If the infant was crying out of earshot of the observer (and often of the mother) it was recorded. If the mother wanted the infant to sleep in the infant's room as usual during the observation session, this was possible. The observer would remain in the living room, checking unobtrusively from time to time through the earphones, out of earshot of the mother, to hear if the infant was still awake. The registration of infant crying may, therefore, interfere less with mother's perceptions and interventions than in the case of a more intrusive paper-and-pencil recording approach in which the observer must always stay close to the mother and infant (Bell & Ainsworth, 1972). We considered infant crying out of earshot of the mother to be relevant for our analyses, because maternal responsiveness also implies arranging the child-rearing environment in a way that facilitates the perception of the infant's signals (Ainsworth, Blehar, Waters, & Wall, 1978).

Infant Crying

Every cry signal separated by a pause of 4 s from the next crying instance and with a minimal duration of 5 s was coded as a crying episode. This somewhat more "molar" operationalization was preferred to a more "molecular" operationalization (minimal duration of 1 s, pause of 2), because it was considered to be more comparable to Bell and Ainsworth's (1972) data. With a few exceptions, results based on the molar and molecular operationalizations appeared to converge (Hubbard, 1989).

Tape recordings were analyzed with a time decoder which displayed the time-table recorded during the observation. Given that there was synchronization between the time-table of behavioral episodes (event recorder) and the time-table of corresponding tape recordings, it was possible for the coders to make an accurate quantitative analysis of infant crying and the interventions of the mother, using the observers' coded observations as a guideline. Six coders analyzed the vocalizations of the infant either in pairs (in the beginning) or alone (after some 25 analyses). They were initially trained using a record of infant crying (Wasz-Hockert, Lind, Vuorenkoski, Partanen, & Valanné, 1968) and our own tape recordings of crying. Vocalizations were analyzed twice before being coded as crying or noncrying. In fact, the analysis of one coder was independently checked by another coder. Disagreements between coders were coded as noncrying. After having been checked by the second coder, the onset and finish of every crying episode was noted.

Mother's Unresponsiveness

The onset and finish of every intervention or intervention sequence was noted with respect to every crying episode. Because we used a sensitive wireless microphone, the vocalizations of the mother were also available on track 2 of the tape recording. Given the time-table recorded on track 1, the onset of verbal interventions was noted from the tape recording. Furthermore, coders

regularly inspected the accuracy of the observers with respect to the timing of maternal interventions. These checks revealed that observers were accurate by means of the event recorder (the coding of onset time took a one-button press) and that the average delay was about 2 s. In the rare case that there was a large discrepancy, this was corrected by the coders using cues from tape recordings. For example, the observer might be less accurate for the intervention "enters room" if a mother rushes to the infant upstairs. The onset of this nonverbal intervention was also available on tape recording because the microphone was in the infant's room.

The duration of unresponsiveness equalled the time the infant cried without an intervention from the mother (mother's delay) and equalled the duration of crying if an intervention started later than 2 s after the crying episode stopped. Maternal interventions were, for example, picking up infant, holding, vocalizing, changing position, offering pacifier or toy, removing noxious stimulus, entering room. The focus of this article is on the delay of maternal interventions, not on the type of intervention (Bell & Ainsworth, 1972). Our frequency measure for maternal unresponsiveness is the percentage of infant cry episodes ignored by the mother. This variable is independent of the number of cry bouts in the same quarter (see next section, reliability). For each quarter, maternal and infant measures were summarized for four successive observations to create more reliable variables.

Reliability

Intercoder Reliability. The time-tabled tape recording of infant crying and maternal vocalizations made it possible to calculate duration of crying and the delay of maternal verbal interventions post hoc in such a way that interobserver and intraobserver error variances due to measurement on the spot were eliminated. The distinction between crying and noncrying was made by consensus (i.e., if there was disagreement among coders about crying, then vocalizations were excluded from the data). For vocalizations of the infant with a minimal duration of 5 s, agreement percentage for crying was 95% for a random sample of 60 visits out of a total of 600 visits. Given the method of consensus, reliability of duration of crying is reduced to the reading of onset and finish on a time-reference axis. The mean agreement among coders for duration of unresponsiveness in cases of verbal interventions was 98.4% for a sample of 60 visits. For nonverbal interventions mean agreement percentage was 95% (from a sample of 14 visits conducted by two observers).

RESULTS

Developmental Changes in Infant Crying and Maternal Unresponsiveness

Table 1 shows that average frequency of crying and unresponsiveness remained about the same across the first 9 months. Duration of crying and

TABLE 1

Range, Mean, Median, and Standard Deviations for Frequency of Infant Crying and Maternal Unresponsiveness in the First 9 Months ($N = 50$)

Quarters	Frequency of Unresponsiveness (%)				Frequency of Crying			
	M	SD	ME ^a	Max-Min	M	SD	ME	Max-Min
First	44.0	16.9	45.0	77-0	10.0	3.8	10.0	22-3
Second	43.0	17.3	40.0	82-16	9.0	4.9	8.0	24-2
Third	42.0	16.9	41.0	79-0	9.0	4.2	8.0	21-1

^aME = Median

unresponsiveness, however, was reduced by half in the third quarter, as was also found by Bell and Ainsworth (1972) and Barr (1989; see Table 2). Bell and Ainsworth found 7.7 min crying per hour in the first quarter and 4.4 min per hour in the last quarter, whereas Wolff (1987) found 6.0 min crying per hour in the first 3 months. These figures are quite comparable with our data.

Thus, infants did not reduce the number of their crying bouts, but after the first quarter they cried for shorter periods. A repeated-measures analysis of variance with age as factor confirmed the trend of decreasing duration of infant crying and maternal unresponsiveness during the first 9 months, $F(2, 49) = 26.40$, $p < .0001$, $F(2, 49) = 16.50$, $p < .0001$, for crying and unresponsiveness, respectively. Post hoc paired comparisons between the first and second quarters and between the first and third quarters were significant at a Bonferroni alpha level of .017 for duration of infant crying as well as for maternal unresponsiveness (for crying between the first and second quarters: $t(49) = 5.42$, $p < .001$; between the first and third quarters: $t(49) = 6.58$, $p < .001$; between the second and third quarters: $t(49) = 2.41$, $p < .05$; for unresponsiveness between the first and second quarters: $t(49) = 3.08$, $p < .01$; between the first and third quarters: $t(49) = 6.30$, $p < .001$; between the second and third quarters: $t(49) = 2.52$, $p < .05$).

Sex and birth-order effects on crying and unresponsiveness were tested through two-way analyses of variance, with sex and birth order as factors and

TABLE 2

Range, Mean, Median, and Standard Deviations for Duration of Infant Crying and Maternal Unresponsiveness (Minutes Per Hour) in the First 9 Months ($N = 50$)

Quarters	Duration of Infant Crying				Duration of Maternal Unresponsiveness			
	M	SD	ME ^a	Max-Min	M	SD	ME	Max-Min
First	6.5	3.5	5.9	15.7-1.0	4.1	2.3	4.0	10.0-1.0
Second	4.4	3.2	3.9	13.4-3.0	3.1	2.6	2.5	12.5-1.0
Third	3.2	1.9	2.9	8.6-5.0	2.1	1.4	1.9	7.8-3.0

^aME = Median

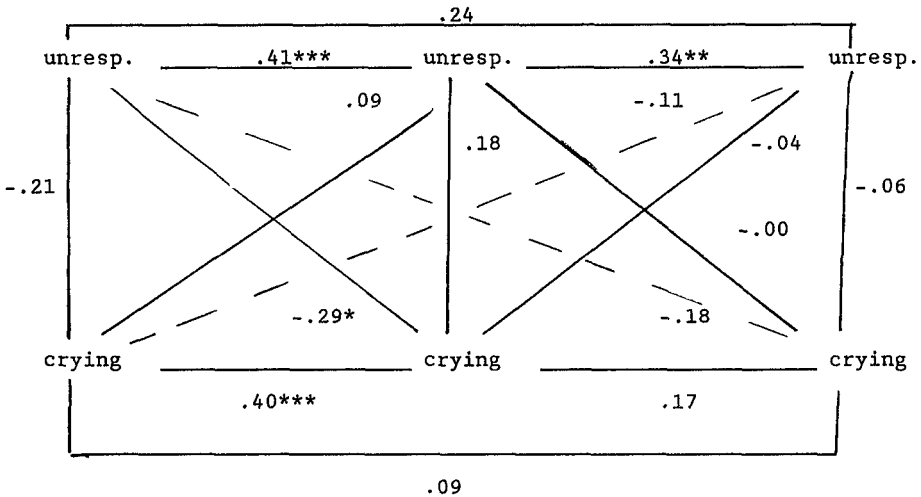


Figure 1. Correlations between frequency of maternal unresponsiveness (%) and infant crying across and within quarters ($N = 50$)

frequency of crying, frequency of unresponsiveness, duration of crying, and duration of unresponsiveness measured in three quarters as dependent variables in four separate analyses. Only one analysis of variance was significant ($\alpha = .05$): Frequency of unresponsiveness in three quarters showed a significant multivariate effect, $F(3,44) = 4.08$, $p < .013$. Univariate analyses of variance showed significant main effects of birth order in the first and third quarters, $F(1,46) = 9.52$, $p < .01$, $F(1,46) = 4.53$, $p < .05$, respectively. In both cases, mothers of second-born infants were more unresponsive than mothers of firstborns.

Correlations Between Frequency Measures

Figure 1 shows that frequency of maternal unresponsiveness was significantly correlated across quarters, indicating a modest stability of maternal behavior.

Frequency of crying was only stable in the first half year. Intraquarter correlations were not significant, indicating that frequency of crying and unresponsiveness were independent within the same quarter. The only significant cross-lag correlation was found for first-quarter unresponsiveness and second-quarter crying. This negative correlation indicated that earlier unresponsiveness corresponded with reduced frequency of crying later in the first half year of life. A multiple regression with frequency of crying in the second quarter as the dependent variable and the second-quarter unresponsiveness, first-quarter crying, and first-quarter unresponsiveness as predictor variables yielded a significant $R^2 = .23$, $p < .001$, as well as a significant negative beta weight ($-.40$), $p < .01$, and a significant negative partial correlation ($-.34$)

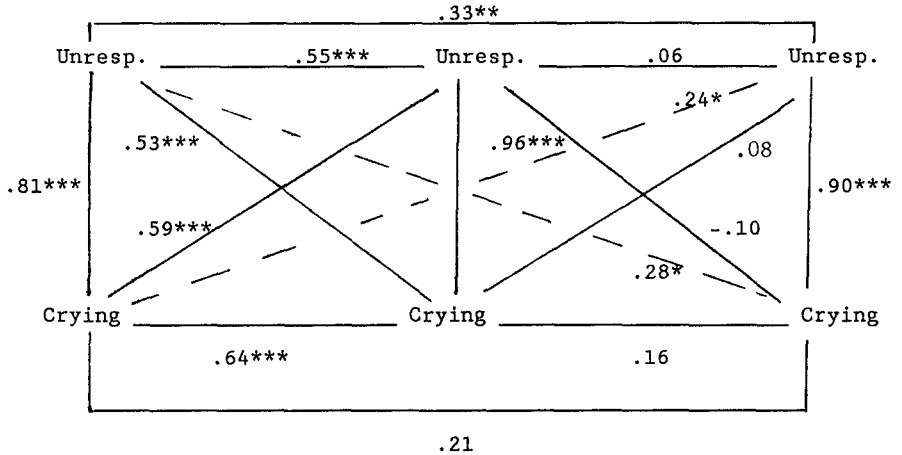


Figure 2. Correlations between duration of maternal unresponsiveness and infant crying across and within quarters ($N = 50$)

for the relation between first-quarter unresponsiveness and second-quarter crying, controlling for first-quarter crying and second-quarter unresponsiveness (Gewirtz & Boyd, 1977a, 1977b). The results of this multivariate analysis, therefore, confirmed the bivariate correlational analysis: In the first half year, earlier unresponsiveness led to less frequent infant crying later on. Analyses of third-quarter crying did not yield significant results.

Correlations Between Duration Measures

Figure 2 shows that duration of maternal unresponsiveness was stable across the first half year; this is contrary to the data of Bell and Ainsworth (1972), who found a more stable pattern in the second half year of the infants' life.

The correlations between duration of unresponsiveness and duration of crying within each quarter were very high and quite comparable with the findings of Bell and Ainsworth, who tried to correct their correlations in an unsatisfactory way (Gewirtz & Boyd, 1977a; Ainsworth & Bell, 1977). A short delay of responses to infant crying appeared to cut short the duration of infant crying instantly (Bell & Ainsworth, 1972; Grossmann et al., 1985). Furthermore, earlier duration of unresponsiveness and later infant crying were significantly correlated from the first to the second quarter (.53), and from the first to the third quarter (.28). If these correlations were not spurious, they would have indicated that infants who cried longer had mothers who were more unresponsive to their infants' crying in earlier quarters. However, the correlations between earlier crying and later unresponsiveness were also considerable, indicating that an unequivocal causal interpretation of the relation between earlier unresponsiveness and later crying was not warranted. Because of the high intraquarter correlations, our data did not

allow for multiple-regression analysis to control for contaminating variables. However, a cross-lag panel analysis was adequate because synchronous correlations did not differ significantly, and because a stable difference existed between parallel autocorrelations, indicating a stationary process (Cook & Campbell, 1979; Kenny, 1975). The reliability of synchronous panels was also comparable, because the same procedures were used to measure unresponsiveness and crying. The largest difference between the three cross-lag correlation pairs was small (.06) and not significant, indicating that the alleged causal relation between duration of unresponsiveness in an earlier quarter and duration of crying in a later quarter was spurious.

Correlations Between Frequency and Duration Measures

Frequency of crying is different from duration of crying because cry bouts may be either very short or very long which means shorter or longer durations of crying in cases of the same number of cry bouts. Mothers may interpret frequent but short crying episodes differently from infrequent, long crying bouts. Frequency of unresponsiveness also differs from duration of unresponsiveness. From the infants' perspective, it may be different to experience many short cry bouts which remain ignored than to experience incidentally a long cry bout which remains ignored (Ainsworth & Bell, 1977).

Frequency and duration measures for unresponsiveness tended to correlate positively ($r = .24$), whereas frequency and duration measures for crying in the same quarter correlated more strongly ($r = .72$). Because Ainsworth and Bell (1977) hypothesized that frequency and duration measures represent different aspects of crying and unresponsiveness, relations between these measures across and within quarters were explored. For the relations between frequency of unresponsiveness and duration of crying, no significant correlations were found. For the relations between duration of unresponsiveness and frequency of crying, however, significant positive correlations were found for the first (.53, $p < .001$), second (.70, $p < .001$), and third (.56, $p < .001$) quarters. Within the same quarter, a longer duration of maternal unresponsiveness was associated with more frequent infant crying. Across quarters, only one correlation was significant: Frequency of crying in the first quarter was correlated with duration of unresponsiveness in the second quarter (.42, $p < .001$). If infants showed more frequent crying in the first quarter, their mothers refrained longer from responding to crying in the second quarter.

DISCUSSION

This study is the first to address the issue of the interrelated development of maternal unresponsiveness and infant crying in a relatively large sample in which mother-infant dyads have been extensively observed at home using

accurate audio- and event-recording equipment to measure the central variables. It is astonishing to notice how similar our descriptive data and the data collected by Bell and Ainsworth (1972) are (see Barr, 1990).

We found that duration of infant crying peaks in the first quarter but decreases rapidly during the later quarters; frequency of infant crying bouts, however, remains the same during the first 9 months of life, indicating that infants on average cry as frequently in the first quarter as in the later quarters, but their crying bouts are shorter. Long crying in the first 3 months has been attributed to the infants' transition from a protected life in utero to an existence more or less independent of the mother's body. For example, the infants are obliged to change their food intake and processing, which may cause gastrointestinal problems of adaptation (Barr, 1989). The infants appear to display crying behavior equally frequently throughout the first 9 months, but they use this behavior more efficiently as they grow, in that shorter bouts appear to be sufficient to fulfill its function.

Sex of infant is not related to either frequency or duration of crying; the same result was also found by Crockenberg and Smith (1982). Birth order, however, appears to influence maternal unresponsiveness. Mothers of second-born infants appear more unresponsive than *primi pari*. This may be explained by differences in experience: Mothers of firstborns may have more problems in relating crying to specific causes (Gladding, 1980). Furthermore, mothers of second-born infants have to divide their attention between two children.

The relation between the duration measures for maternal unresponsiveness and infant crying is quite complicated because of the high intraquarter correlations between the two measures. These high correlations indicate the effectiveness of maternal interventions in cutting short infant crying instantly (Bell & Ainsworth, 1972). We have to qualify, however, this conclusion in two respects. First, intraquarter correlations cannot be interpreted causally, and the conclusion that mothers should respond promptly to reduce duration of infant crying cannot, therefore, be based on intraquarter correlations. Second, we expect to find high intraquarter correlations for duration measures in every study using accurate recordings of crying and unresponsiveness: Both variables are *intrinsically related in that the longer an infant cries, the longer the unresponsiveness will probably last*, and if the infant cries only for a short period, the duration of maternal unresponsiveness cannot be long either. Any causal interpretation of correlations between duration measures should therefore be based on cross-lag correlations. Our cross-lag panel analysis, however, showed that unresponsiveness in an earlier quarter could increase crying in a later quarter, and crying in an earlier quarter could increase maternal unresponsiveness later on. Therefore, our data do not allow for unidirectional causal interpretations of the cross-lag correlations. In

exploring the relations between frequency and duration measures, we found that within the same quarter, a longer duration of maternal unresponsiveness was associated with more frequent infant crying. Before jumping to causal conclusions implying a temporal order of cause and effect, however, the across-quarter correlations should be taken into account. More frequent crying in the first quarter was found to be associated with longer maternal unresponsiveness in the second quarter, but the reverse was not true. This finding is therefore inconsistent with the hypothesis that earlier unresponsiveness stimulates later infant crying.

The relation between the frequency of maternal unresponsiveness and frequency of infant crying is rather clearcut: Earlier maternal unresponsiveness leads to less frequent infant crying later in the first half of life. In retrospect, this outcome makes intuitive sense: In this study—as well as in the study of Bell and Ainsworth (1972)—responsiveness has been defined exclusively as promptness of response to as many cry and fuss bouts as possible. However, responding promptly to every cry and fuss signal not only seems to be impossible in everyday life with its many competing demands but should also not be equated to the appropriateness of response, which is the decisive marker of responsiveness in the widely used responsiveness scale of Ainsworth, Bell, and Stayton (1974). Responsiveness to crying may have been too narrowly defined as promptness without taking into account that a prompt response can imply overstimulation that hinders the infants' development toward security and autonomy (Belsky et al., 1984). For example, in many cases prompt response to infants' fusses signalling their inability to change their body posture at the first trial may in fact be unresponsive to the infants' need to learn to master their own body posture (Landau, 1982). We conclude, therefore, that promptness of response (emphasized by Bell & Ainsworth, 1972) is neither a necessary nor a sufficient condition of responsiveness, and that appropriateness of response as indicator of responsiveness has been rightly emphasized, especially in Ainsworth's further reports on the Baltimore study (Ainsworth et al., 1978).

The concept of differential responsiveness is hypothesized to explain our results. This concept implies that only severe distress vocalizations (e.g., pain or hunger cries) should be conceptualized as evolutionary "biased" attachment behavior, requiring a prompt response. The development of mild distress vocalizations ("instrumental cries") may not need to be interpreted in terms of attachment but may be explained in terms of conditioning. Bowlby (1971, p. 347) considered crying a graded signal (Murray, 1979), carrying different information depending upon context, intensity, and rhythm (Thompson & Lamb, 1984), and he did not think it necessary for mothers to react promptly to all crying behaviors (see also Ainsworth, 1973). A delayed response to mild distress may enable the child to learn to cope with the kind of situations in which mild distress arises. Furthermore, simultaneously ignor-

ing fussing behavior but being responsive to other behaviors such as exploratory play might diminish mild distress vocalizations (Lester, 1985). Only a minor percentage of infant crying behavior consists of pain or panic cries (Wolff, 1987) and might be considered attachment behavior. The concept of differential responsiveness may therefore explain why in our study of normal infants who mostly displayed short, "nonattachment" crying behavior, maternal unresponsiveness leads to less frequent crying bouts later in the first half year of life.

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