
Temperament, Early Experiences, and the Behavior of Mothers Vs. Strangers as Influences on Infant Crying

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To address questions about the relationship of both environmental and biological variables to individual differences in infants' reactions to strangers and mother, this study compared extended interactions between strangers versus mothers with the same 2- and 5-month old infants. Two visits were made to the infant's home, once to observe the infant with the mother and once with the stranger. Infants fussed and cried significantly more often with strangers and positively vocalized more with their mothers. The infants' frequency of crying with strangers was not found to be related to the stranger's immediately preceding behavior. Other variables, such as those having to do with problematic events surrounding the infant's birth and with infant temperament, were also not related to individual differences in infant crying when with strangers. One thing that might account for differences in how much infants cry with strangers was that strangers had more difficulty in consoling infants.

When infants of about eight months of age are approached by a stranger, they will exhibit many behaviors. Some of these may be considered positive, such as smiling and vocalizing to the stranger. Others, such as looking away, turning away, or crying, may be considered negative. These negative behaviors have been called "stranger anxiety" (see Clarke-Stewart, 1978 for a review). Following Clarke-Stewart's review, there were few additional studies of stranger anxiety. Perhaps the review convinced researchers that there were few interesting issues left to study. Perhaps equally influential was the work of Kagan (1976). He used a number of different data sets, from different cultures, to show similar growth functions and a characteristic peak of stranger anxiety at around eight months of age. Based on these data, he declared that fear of strangers was a universal developmental phenomena, which could best be explained by maturation of the brain. This again might have suggested to researchers that there was no reason for further study.

There are some important reasons, however, why further study is warranted. Earlier work focused on normative trends, averaging across infants. Why some infants, in some situations, may have had either a more or a less intense reaction was never examined. While reactions to strangers may have a biological basis, from a dynamical systems perspective (e.g. Novak, 1996) it would be expected that differences in individual infants' reactions to strangers could result from a number of interrelated

factors, both environmental and biological. This paper will examine the influence of both environmental and biological factors on infants' reactions to strangers.

The first factor that may be important is that in a situation in which two people are interacting with each other, there may be an influence of the one person's behavior on the other's. This is a purely environmental stimulus variable. So, for example, the infant may either respond differently to similar behaviors depending on whether a stranger or a mother performed the behavior, or perhaps the stranger's behavior is somehow different from the mother's and this causes a reaction in the infant.

The second factor that may be important is that different kinds of history and experiences of infants over time may affect their reactions to strangers. Variables based on these experiences measure aspects of the infant's reinforcement history. Two aspects of the infant's history will be studied here. The first, is whether there were any problems surrounding the infants' birth. Such problems can best be seen as being a combination of biological and environmental factors. For example, the development of infants born before their due dates may show adverse consequences due to the fact of their premature birth (a biological fact). It has been shown, however, that parents of such infants also interact with them differently, and this may have short and long term effects as well (see, for example, Kopp, 1983). The sample for the current study consisted of infants who were chosen for as much normality as possible. Families were middle class, and infants who were premature or had other major difficulties were excluded. Nevertheless, there may be some effects of differences in experiences surrounding the birth, such as type of delivery, length of labor or use of anaesthesia (e.g. Brackbill, McManus & Woodward, 1985). Such experiences may have the general effect of increasing infant irritability, at least in the short run, and may also be stressful for the mother, which may change the kinds of interactions that take place between mother and infant.

Another aspect of the infant's history is their previous exposure to caregivers other than the mother. One study (Lamb & Malkin, 1986) showed that at least initially, changing caregivers can disrupt infant behavior. For example, very young infants cried more after a change in care-

givers. However, it would be expected that if infants had extended interactions with a variety of caregivers, they might learn new behaviors that make it less upsetting to interact with a new caregiver. In support of this, it has been shown that after extended interactions with nonmaternal caregivers, infants can develop attachment relationships with them (Howes, 1999)

The third factor that may be important is the infant's temperament (as perceived by the mother). This may be an important biologically-based influence on how infants react to an unfamiliar person or situation (e.g., Goldsmith & Campos, 1990). In particular, an infant's tendency to approach or withdraw from novelty, to adapt easily to new situations, to have a low or a high threshold of reactivity, to react with high or low intensity to experiences, and to be generally in a good mood or not, may all affect how they would react to a stranger.

The Current Study

The majority of past studies of infants and strangers focused on infants six months or older. Eight months was apparently established as the peak of stranger anxiety, and studies were planned around that "fact". Investigating stranger reactions in younger infants can begin to elucidate some of the origins of stranger anxiety in earlier infancy. This study, then, will focus on infants younger than six months of age.

In planning a study of infants' interactions with strangers, it is important to note that the majority of such subjects examined very brief encounters in relatively "strange" situations, and so may not have that much applicability for infants in the real world (Clarke-Stewart, 1978). They were, in effect, examining the behavior of unfamiliar individuals, engaging in generally strange behavior, in unfamiliar situations (to slightly paraphrase Bronfenbrenner, 1979). Although some of the situations in which infants encounter strangers are of this kind, it is probably equally common for infants to encounter strangers who come to their homes, perhaps as babysitters or friends of their parents.

The current study examines extended interactions between strangers and young infants (two and five months of age) and compares these to similar interactions between these infants and their mothers. These extended interactions with strangers were designed to be similar to an initial babysitting situation. The current situation differs from the situations in traditional "stranger anxiety" studies the following respects: it is much longer in length, it attempts to be naturalistic rather than artificial, and the stranger enters the situation with the instruction that they are to behave as a caregiver to that infant during the interaction. The mother was never available during these interactions to rescue either the stranger or the infant. Will there be any evidence that even young infants differentiate in their behavior between strangers and mother? If this differentiation is present, what environmental and biological variables are related to it?

METHOD

Participants

The participants in this study were 24 two- and 24 five-month-old first-born infants; half at each age were boys and half were

girls. Only infants whose mothers had chosen to stay at home (at least during these early months of life) were chosen for the sample.

Procedure

Two visits were made to the infant's home. During one visit the infant was observed in interaction with his or her mother; during the other visit they were observed in interaction with the stranger. Whether the mother or the stranger was observed first, was counterbalanced. Eight different strangers, all female, worked in the study. They were selected because they all had previous experience caring for infants. Four were mothers themselves, and the other four had extensive babysitting experience, and had responded to an ad that said, "Do you like babies?" and then explained the study.

Each visit consisted of three trials. The first 15-minute trial consisted of unstructured play or interaction. Mothers and strangers were simply told to interact with the baby the way that they would if "they had nothing else to do." The second trial, which lasted approximately five minutes, consisted of a diaper change (whether the baby 'needed' one or not). The third trial, called the stressor trial, was variable in length. During this trial, three mildly stressful events (e.g. washing infant's face, or putting the infant down by itself on a quilt on the floor) were administered by the observer. After a predetermined amount of time, the caregiver (whether stranger or mother) was asked to pick the baby up. If the baby was crying, they were to try and console them.

A single observer recorded infant and caregiver behaviors on a MORE micro-processor event recorder. The 57 caregiver and 45 infant behaviors were collapsed into 12 caregiver behavior categories and 11 infant behavior categories (Table 1). These categories, originally developed for an observational study done with the Gusii in Kenya (LeVine et al., 1994), have also been used in studies of Boston mothers and infants and Mexican mothers and infants (LeVine, Miller & Richman, 1996; Richman et al., 1988; Richman, Miller & LeVine, 1992)

Table 1
Collapsed Behavioral Coding Categories

INFANT	CAREGIVER
Fuss/cry	Vocalize
Positive vocalize	Imitate/laugh
Smile	Smile/playface
Negative expressiveness	Gesture/games
Self-console	Caretaking
Look	Look
Physical	Soothing physical contact
Object mediated	Jazzing up/exercising
Next to	Pick up
Noninteractive	Next to
Miscellaneous	Object mediated
	Non-interactive
	Miscellaneous

Additional data about both the infant and his or her early environment were also collected via questionnaires. One questionnaire asked simple questions about the infant's birth and about the care environment since birth. For example, mothers were asked about the infant's birthweight and length, who delivered the infant, what problems, if any, did the mother experience, what problems, if any, did the infant experience, the length of labor, what type of delivery and what type of anesthesia was used. With respect to the care environment, mothers were asked a variety of questions, including who helped the mother immediately after the birth, who had helped take care of the infant since that time, and how many people had helped the mother with childcare. One month after the observations were completed, the mothers also filled out the Revised Infant Temperament Questionnaire (Carey & McDevitt, 1978).

RESULTS

Did the infants behave differently with the mothers and the strangers? This needs to be established here before any possible bases for such differentiation could be examined. Differences between the mean proportions of seven infant behaviors (fuss/cry, vocalize, smile, look, physical, object mediated and noninteractive) when two- and five-month-old infants were either with the mother or with the stranger were tested using a three-way ANOVA. Trial type (play, diaper change or stressor) was the third factor. The mean proportions for the infant behaviors with each caregiver are presented in Table 2. Results shown here will not include age differences or differences in behavior across trials because there were no significant interactions of caregiver with either age or trial type.

Table 2
Proportions of selected behaviors by infants (irrespective of age) when being cared for by mothers versus strangers

	Mother	Stranger
Fuss/cry	.184	.242 **
Positive vocalize	.173	.122 ***
Smile	.038	.030 +
Look	.198	.193
Physical	.019	.018
Object Mediated	.097	.117 +
Noninteractive	.193	.178

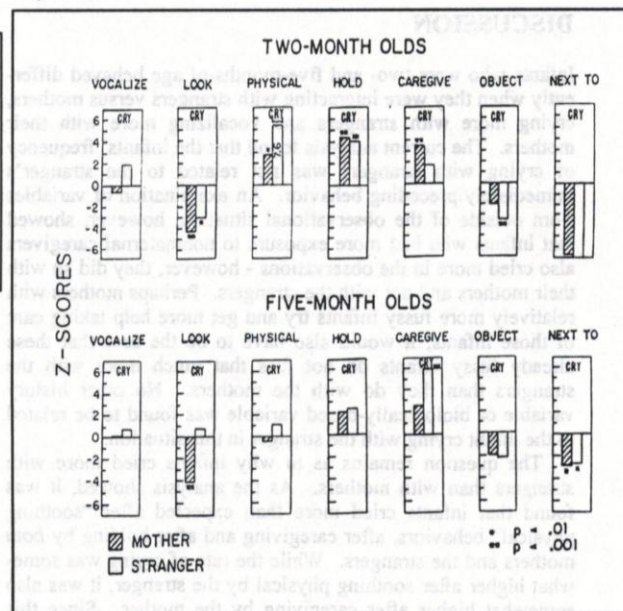
+ Statistical trend
** $p < .01$
*** $p < .0001$

Table 2 shows that infants fussed and cried significantly more often when with strangers, $F(1,273) = 6.59, p < .01$, and positively vocalized more when with their mothers, $F(1, 273) = 23.14, p < .0001$. Smiling occurred more frequently when infants were with their mothers, and object mediated behavior occurred more frequently when infants were with strangers, but these were only statistical trends.

The analysis will now focus on the possible reasons for the finding that infants cried more when being cared for by strangers than when being cared for by their mothers. The first hypothesis is that it is possible that the stranger was engaging in behaviors that lead to increased crying (and perhaps decreased positive vocalizing) in infants. This hypothesis may be tested by using sequential analysis. Sequential analysis is a way of examining what is the effect of the immediately preceding stranger or mother behavior (at time 1) on infant behaviors that follow it (at time 2). The relationships are expressed in terms of conditional probabilities that tell us *how often* an infant behavior occurred after a particular caregiver behavior, compared to how often that behavior occurred overall. A z-score is used to express the significance of the difference between the conditional probability and the baseline probability (Faraone & Dorfman, 1987; Sackett, 1979). Significant findings reported here involve z-scores of at least $\pm 1.96 (p < .05)$.

Figure 1 shows that following each of the following three behaviors by either caregiver—soothing physical, holding and caregiving—the probability of infant crying is significantly higher than baseline, particularly for two-month-old infants. Although the change from baseline is especially high following soothing physical by the strangers, it is also somewhat higher for mothers following both holding and caregiving actions. After other types of behavior, there is little evidence that infant crying is higher following the same behavior of strangers and of mothers.

Figure 1.
Extent to which infant crying was more or less frequent following seven caregiver behaviors for two-month olds (top panels) and five-month olds (bottom panels).



Perhaps other aspects of the infants' environment, particularly the infant's history, were more influential on their behavior. The first set of "history" variables had to do with whether or not the mother used alternative caregivers during the infants' first few months of life. Although all of these mothers had chosen to stay home with their infants, they nevertheless differed in the degree to which they had enlisted help from caregivers outside of the family. Perhaps infants with more experience with nonmaternal caregivers would react differently to strangers.

In fact, different measures of infants' experience with strangers did show some relationships with the simple proportions of crying with both mother and stranger. Here, the alpha level of .05 required for significance was adjusted using the Bonferroni procedure to reflect the fact that three comparisons are being made. The adjusted alpha level was $p < .017$. A $p < .03$ was equivalent to .09, being at the level of a statistical trend. Using this more conservative criterion, it was found that the more people who had helped the mother care for the infant since the infant's birth, the more fussy the infant was likely to be with the mother during both play, $r(47) = .34$, $p < .03$ (a trend), and during the stressor trial, $r(47) = .39$, $p < .007$, which was significant. Infants who were cared for by more outside caregivers since birth were not found to be fussier with the strangers.

Nine variables having to do with the potential effect of problematic events surrounding the infant's birth (things such as use of anesthesia, type of delivery, length of labor, and so forth) were not related to infant crying with either the mother or the stranger. Measures of temperament, a more biologically-based variable, were also not found to be related to infant crying.

DISCUSSION

Infants who were two- and five-months-of age behaved differently when they were interacting with strangers versus mothers, crying more with strangers and vocalizing more with their mothers. The current analysis found that the infants' frequency of crying with strangers was not related to the stranger's immediately preceding behavior. An examination of variables from outside of the observational situation, however, showed that infants who had more exposure to nonmaternal caregivers also cried more in the observations - however, they did so with their mothers and not with the strangers. Perhaps mothers with relatively more fussy infants try and get more help taking care of those infants; it would also have to be the case that these already fussy infants do not fuss that much more with the strangers than they do with the mothers. No other history variable or biologically-based variable was found to be related to the infant crying with the stranger in this situation.

The question remains as to why infants cried more with strangers than with mothers. As the analysis showed, it was found that infants cried more than expected after "soothing physical" behaviors, after caregiving and after holding by both mothers and the strangers. While the rate of crying was somewhat higher after soothing physical by the stranger, it was also somewhat higher after caregiving by the mother. Since this sequential analysis does not distinguish between the first, second, third, fourth, or nth behavior in a sequence of behavior,

one interpretation of these findings is that mothers and strangers were engaging in behaviors such as holding, soothing physical, and caregiving, during extended cry bouts by infants (see Gewirtz & Peláez-Nogueras, 1992). It appears as if the mother or stranger behavior might be causing the crying, when all that is happening is that the crying is ongoing. In work not reported on here, Miller (1993) found that infants being taken care of by strangers did not actually start crying more often. Instead, once they started, they cried for longer periods of time. This suggests that the strangers may have had more difficulty consoling the infants than the mothers did; as the result of this, the strangers may have to engage in more soothing physical as part of their consoling efforts. This might be an effect that would only be seen in the first one or two encounters between an infant and a new caregiver, and if one observed these interactions over time with the same caregiver, increased crying to the nonmaternal caregiver might disappear. In other words, infants and caregivers need interactional experience to learn about each other.

Clearly, while there may be a normative developmental reaction to strangers that peaks around 8 months of age (Kagan, 1976), the behavior of younger infants suggests that who is taking care of them makes a difference. The behavioral differences seen here are also confirmed by a variety of studies that show that even very young infants prefer their mother's voice, prefer breast pads worn by their mother to those of a stranger, and show other related preferences. These early reactions to strangers do not, most likely, constitute "stranger anxiety." Nevertheless, they are a precursor to the later development of such stranger reactions. It is also clear that different infants, whether younger or older, react differently to strangers. These differences may be related to both biologically-based characteristics of the infant and to characteristics of the environment. In a study with a more diverse sample, the effect of some of these characteristics may have been more clear.

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