Published in final edited form as:

Soc Dev. 2010 November ; 19(4): 799–821. doi:10.1111/j.1467-9507.2009.00565.x.

Mothers' and Children's Positive Emotion: Relations and Trajectories across Four Years

Julie Sallquist,
Arizona State University

Nancy Eisenberg,
Arizona State University

Tracy L. Spinrad,
Arizona State University

Bridget M. Gaertner,
Arizona State University

Natalie D. Eggum, and
Arizona State University

Nianli Zhou
East China Normal University

Abstract

The goals of this study were to examine the relations between and trajectories of mothers' and children's social positive expressivity. Mothers' and children's positive expressivity (PE) were observed annually for 4 years beginning when children were approximately 18 months old ($n = 247$; 110 girls). Based on correlations, there was evidence of rank-order stability in children's and mothers' PE. Based on growth curve analyses, mothers' and children's PE followed curvilinear trajectories; thus, mean-level instability was found. Children's PE during a free-play interaction with their mothers increased then decreased slightly whereas mothers' affect during the same task decreased then stabilized. Children's PE during a joy-inducing situation (i.e., bubbles) with an experimenter slightly decreased and then increased. In panel models, there was no evidence of prediction over time across children's and mothers' PE when taking stability into account. These unique trajectories and relations provide insight into the developmental pattern of young children's and their mothers' PE elicited within social contexts.

Keywords

Positive emotion; trajectories; socialization of emotion

Positive expressivity (PE) often plays an important role in social engagements, in part because it acts as a signal for friendly interactions (Izard & Ackerman, 2000). Within the first year of life, infants express positive affect during social interactions (e.g., social smiles; see Lewis, 2000), and in the first few years of life, their understanding of their own and others' emotional displays and experiences undergoes rapid advancements (see Saarni,

Correspondence can be emailed to Julie Sallquist at julie.sallquist@asu.edu.

Julie Sallquist is now at Arizona State University, School of Social and Family Dynamics; PO Box 873701; Tempe, Arizona 85287-3701; Phone: 480-965-6917; Fax: 480-965-6779

Julie Sallquist, Nancy Eisenberg, and Natalie D. Eggum, Department of Psychology, Tracy L. Spinrad and Bridget M. Gaertner, School of Social and Family Dynamics. Julie Sallquist is now in the School of Social and Family Dynamics.

1999). Throughout childhood, researchers have found positive relations between PE and social competence (Halberstadt, Denham, & Dunsmore, 2001; Lyubomirsky, King, & Diener, 2005; McDowell & Parke, 2005). Given the role of PE in adjustment, it is important to understand its early development and to examine children's PE within social contexts across time.

Parents are thought to play a key role in regulating infants' and young children's emotional experiences (see Bell & Wolfe, 2004). Researchers have found positive relations of maternal PE with preschoolers' emotional understanding (Laible & Song, 2006) and cognitive functioning (Dunsmore, Halberstadt, Eaton, & Robinson, 2005). Denham, Mitchell-Copeland, Strandberg, Auerbach, and Blair (1997) found that mothers who displayed relatively high levels of PE with their children had children who displayed more PE during peer interactions. These positive peer interactions are likely to enhance children's social competence.

Although researchers have examined dyadic exchanges of affect for decades, much of this research has involved infants and has assessed only concurrent relations within parent-child interactions (see Denham, Lehman, Moser, & Reeves, 1995; Kochanska, Aksan, Penney, & Doobay, 2007 for exceptions). Another gap is that there has been more of an emphasis on examining the expression and regulation of children's negative affect compared to positive affect. Investigating PE across time is important for understanding the maturation of emotion regulation and its potential implications for social development.

The primary aim of the present study was to address the aforementioned gaps in the literature. Specifically, this study examined young children's PE across four years and the relations between children's and mothers' PE. Children's PE was observed in the mother-child dyad and in social interactions with a non-familial adult. Examination of two contexts provided more nuanced information regarding the trajectories of PE. We also examined two types of stability in PE useful for understanding development: (a) rank-order (i.e., change in individual differences) and (b) mean-level (i.e., change in average level of a variable; De Fruyt et al., 2006).

Positive Emotion

Rothbart and others view positive emotionality as a component of temperament—a set of constitutionally based traits that are the core of personality and influence the directions for development (Rothbart & Bates, 2006). In contrast to other temperament-based emotions, positive affect has been found to have larger environmental effects than genetic influences (Plomin et al., 1993), which highlights the potential contribution of a child's surroundings in shaping his or her development. We use the term emotionality when referring to temperamental/dispositional traits (e.g., smiling and laughter). Expressivity (i.e., a specific marker of affect—e.g., a smile) is viewed as a situational experience and/or display of affect that stems partly from emotionality. Table 1 summarizes the reviewed literature.

Children's PE

Consistent with the view that temperament is somewhat stable over time, reported positive affect has been found to exhibit some rank-order stability (low to moderate strength correlations) throughout infancy and toddlerhood (Denham et al., 1995; Lemery, Goldsmith, Klinnert, & Mrazek, 1999), although relations are not very consistent in observed scripted scenarios (Kochanska et al., 2007). More specifically, Kochanska et al. (2007) found several relations across time in children's observed PE in one study but few significant relations in another study. However, there was some rank-order stability in children's observed PE in naturalistic mother-child interactions in both studies. Kochanska (2001) also found rank-

order stability in PE during peek-a-boo. Thus, there appears to be rank-order stability for PE, although more with reported than observed measures.

Regarding mean-level stability, there is some evidence that PE increases across the first two years of life. For example, Denham et al. (1995) found that infants' parent-rated positive affect increased from 6 weeks to 19 months. In a study with observed PE, Malatesta, Grigoryev, Lamb, Albin, and Culver (1986) found that infants' PE increased linearly from 2.5 to 7.5 months. Lavelli and Fogel (2005) found a curvilinear (i.e., increasing then flattening out) trajectory of infants' smiling while interacting with their mothers from 3 weeks to 3.5 months of age. In another study, Venezia, Messinger, Thorp, and Mundy (2004) found that there was an increase in the number of 10-month-olds who exhibited anticipatory smiles towards an experimenter compared to the number of infants two months prior; stability was found between 10 and 12 months. For reactive and indeterminate smiles, there was stability across 8, 10, and 12 months.

Overall, it is unclear if the discrepancies among studies are due to methods of assessing affect (i.e., reported or observed) or to participant characteristics (e.g., age). To date, there is relatively little research that examines within the same sample both the mean-level and rank-order stability of PE after 18 months of age. Beyond 18 months, PE may increase due to children's greater understanding of its value, which in turn may facilitate positive social interactions. Additionally, young children become better able to engage socially (Bakeman & Adamson, 1984) and understand others' emotions (see Denham, 1986), which might assist in learning about the role of PE in social contexts. It is also possible that as self-regulation develops, children are increasingly likely to modulate their exuberant and unregulated behavior (see Rothbart & Bates, 2006). Thus, there are reasons to expect an increase or decrease in PE.

Children's sex—A body of research suggests that, due to gender roles, girls may be socialized more than boys to express positive affect as a way to be social (see LaFrance, Hecht, & Paluck, 2003), which could result in sex differences in PE. The findings regarding sex differences in children's positive affect are mixed. In a meta-analysis, Else-Quest, Hyde, Goldsmith, and Van Hulle (2006) found that boys (13 months to 13 years) were viewed by adults as higher than girls in high-intensity pleasure (e.g., exuberance) whereas girls were higher than boys in low-intensity pleasure (e.g., positive mood). However, such sex differences have not always been found (Grolnick, Cosgrove, & Bridges, 1996; Volbrecht, Lemery-Chalfant, Aksan, Zahn-Waxler, & Goldsmith, 2007). One possible explanation for sex differences or the lack thereof is mothers' own levels of PE, which may contribute to differences or similarities in girls' and boys' PE. Additionally, any differences may vary depending on the age of the children.

Maternal PE

Researchers have found some evidence of rank-order stability in mothers' PE across contexts and/or modes of measurement. Izard, Libero, Putnam, and Haynes (1993) found moderately strong rank-order stability in mothers' self-rated positive affect from their children's birth to age 3. Other researchers examining mothers of infants have found rank-order stability in PE (Biringen et al., 1999; Izard, Haynes, Chisholm, & Baak, 1991), although stability has not always been found (Kaye & Fogel, 1980). In a study of older children (average age of 6 years), Eisenberg et al. (2003) found stability between parents' self-rated and observed PE within parent-child interactions across two years. Stability in mothers' PE also has been found in other studies or follow-ups with school-age children (see Eisenberg et al., 2005; Valiente et al., 2006).

Regarding mean-level stability, Kaye and Fogel (1980) found that maternal PE generally was stable across 6 weeks to 6 months during mother-infant interactions; however, when the specific durations that infants were attending to their mothers were examined, rates of PE increased across time. In another study, Dunn, Creps, and Brown (1996) found that mothers' PE during parent-child interactions was stable across 33 to 69 months. Other researchers have found mean-level declines in mothers' PE (infancy—Biringen et al., 1999; toddlerhood—Robinson, Little, & Biringen, 1993). It appears that there is rank-order stability in mothers' PE but the findings regarding mean-level stability are mixed and appear to depend on children's age.

The Relations between Children's and Mothers' Positive Emotion

Conceptually, positive relations between mothers' and children's PE would be expected given the genetic aspect of PE in temperament and the sharing of affect that occurs in dyadic contexts. Moreover, children may model and imitate their mothers' behaviors. Researchers have found a consistent positive relation between parents' and children's PE (Denham, 1989; Halberstadt & Eaton, 2003; Kochanska, Friesenborg, Lange, & Martel, 2004), which becomes more robust with age (Halberstadt, Crisp, & Eaton, 1999; Nwokah, Hsu, Dobrowolska, & Fogel, 1994). Researchers also have found that children smile more at their mothers when their mothers smile more at them and that shared positive affect increases across time (Kaye & Fogel, 1980).

One variable that may affect the relation between maternal and child PE is children's sex. There is mixed support, however, for the notion that the relations are stronger between mothers' and daughters' PE compared to sons' PE. Rosen, Adamson, and Bakeman (1992) found that girls' approach tendencies in a positive emotion-eliciting context (proxy for positive emotional arousal) were more related to maternal positive affect than were boys'. In contrast, Biringen et al. (1999) found that a composite of mothers' positive behaviors (including PE) was predictive of sons' PE but not daughters'. As explained by Biringen et al. (1999), these findings are consistent with other findings of mothers using more structured behaviors to promote matching affect with their sons than daughters. Other researchers have not found sex differences in the relations between mothers' and children's PE (Kochanska et al., 2004; Martin, Clements, & Crnic, 2002). Given the mixed findings, it is likely that the relation between mothers' and children's PE depends on the type (e.g., social, non-social) and context (e.g., observed or reported) of PE.

Another variable that may affect mothers' behaviors is children's age. Perhaps mothers differ less in their emotional expressivity with their sons and daughters when their children are younger compared to when their children are older. This could be partially due to an increase in mothers' gender-typical expectations as their children grow older.

The Present Study

In the present study, the relations between mothers' and children's PE and the trajectories of PE were examined over a four-year period. Due to the constitutional bases of PE, we predicted that children's PE with their mothers and a stranger (i.e., female experimenter) would exhibit rank-order stability across time and context. We also expected rank-order stability for maternal PE because of the likely similarities in mothers' behaviors across time during free play with their children (e.g., Spinrad et al., 2007).

Even though positive emotionality has a constitutional basis, it also appears to be substantially influenced by the environment. Thus, because of the changing dynamics in a child's environment throughout toddlerhood as well as in children's cognitive development and numerous other abilities such as self-regulation (e.g., Kopp, 1982; Rothbart & Bates,

2006), it seemed unlikely that children's PE would remain stable in mean level (unless the majority of children were initially at the ceiling level). Because PE typically signals and maintains social interactions, children's PE was not expected to decline, despite increases in self-regulation that might modulate its intensity. Thus, children's PE was predicted to increase due to their greater understanding of the social value of expressing positive emotion and expressive social skills.

Trajectories of mothers' PE were predicted to be stable (McCrae & Costa, 1990). However, it seemed possible that mothers could express more affect with younger than older children in an attempt to manage children's affect. As children develop the ability to engage and facilitate play, mothers may express less affect because they have less need to elicit engagement. Alternatively, some mothers may find playing with their older children more stimulating because their children are more engaged and thus express more positive affect.

Finally, we hypothesized positive relations between mothers' PE and children's PE within and across time, especially within free play (see Halberstadt et al., 1999). We also predicted maternal PE would predict children's PE across time and vice versa (see Eisenberg, Cumberland, & Spinrad, 1998). Finally, even though previous results are mixed regarding the relations of girls' and boys' PE with their mothers' PE, we expected stronger relations between children's and maternal PE for girls than for boys. These relations were expected because the assessments of PE were in a social context and included only expressivity and not other positive behaviors (see Brody, 1993; Else-Quest et al., 2006). We also expected this pattern of relations to be apparent especially at older ages as mothers' gender-role expectations likely increase with age.

Method

Participants—Primary caregivers, generally mothers, and children participated in assessments at 18 months (T1; $n = 247$), 30 months (T2; $n = 216$), 42 months (T3; $n = 192$), and 54 months (T4; $n = 168$). There was one grandmother and one father primary caregiver at T1 (preliminary analyses with and without the father's data were not different); thus, we use the term mother for simplicity. Initially, families were recruited at local hospitals shortly after the child's full-term and typical birth. Mothers' average age was approximately 29 years (range = 19 to 44 years) and 83% ($n = 205$) were married, 9% ($n = 21$) were single but cohabitating, 3% ($n = 8$) were single, and 3% ($n = 7$) were divorced or separated (2% did not report marital status at T1) (see Table 2).

Attrition Analyses: From T1 to T2, 12.6% dropped out of the study; T2 to T3, 11.1% dropped out; T3 to T4, 12.5% dropped out (these families either had moved or could not be reached and approximately 6–8% of families chose not to participate). MANOVAs or χ^2 analyses were computed for demographic and major study variables. There were no differences between T4 participants and those who dropped out after T1.

Procedure—Children and their primary caregivers came to a university laboratory in a large metropolitan area. Children participated annually in observational assessments beginning at 18 months in order to examine toddlers before the acquisition of advanced self-regulation. A trained female undergraduate experimenter administered the tasks; before an assessment, several weeks of training (led by an experienced graduate student) occurred. Mothers provided demographic information. Children received a small toy; mothers received a modest payment. In order to encourage participation, newsletters and cards were mailed to the families.

Measures—Observations were used to assess children's and mothers' positive expressions. The observational measures were coded from videotape, and reliability (intraclass correlation, ICC) was established on approximately 25–30% of the sample. All coders were trained and supervised by a graduate or post-doctorate level researcher who was a trained expert in facial emotion coding. For training, coders met once or twice a week for a minimum of several weeks (and sometimes months) until they were reliable with each other's and the supervisor's coding, which was based on criteria established by the principal investigators. Specifically, coders initially reviewed tapes together and then reviewed tapes that they coded independently. During training, all discrepancies were discussed until agreement was reached. Training ended when the tapes coded independently had acceptable levels of reliability ($ICC > .75$). Throughout the coding, the supervisor calculated inter-rater reliability weekly or biweekly, and to avoid observer drift, when the inter-rater reliability dropped, the supervisor reviewed the coding guidelines with the coders. All coders were female research assistants (i.e., undergraduate, graduate, and post-doctorate level) and all were Caucasian except for two reliability coders who were Asian (one Asian-American and one Chinese). For each measure, a mean composite score of the codeable epochs was created. Cronbach's alphas were computed to examine the consistency across the epochs.

Children's PE: At each assessment, children and their mothers engaged in a 3-minute free-play session. The experimenter instructed parents to play with their children with a set of toys as if they were at home and then left the room. The toys were age-appropriate for all assessments (e.g., fire truck with people and dog; cymbals; cooking pot with fruit and spoon; fish, container for fish, and fishing pole; baby doll; book; pop-up toy—tractor with farmer and animals). Children's PE (e.g., smiling, positive tone of voice, or laughter) was coded in 15-second intervals on a 4-point scale (1 = *no display of positive affect* to 4 = *intense [open-mouth smile or laughing], prolonged display of positive affect for majority of epoch*; ICCs = .71, .89, .77, and .76 at T1, T2, T3, and T4; alphas = .76, .77, .79, and .78 at T1, T2, T3, and T4). Mother-child free play interactions have been used in numerous studies (e.g., Malatesta et al., 1986; Martin et al., 2002). Even though our measure was somewhat shorter in duration than in previous studies, it still elicited PE and was consistent in rank order across time.

In the second context, the intensity of children's PE was coded in 5-second intervals while the experimenter blew bubbles for 1 minute (1 = *no display* to 4 = *intense display*; ICCs = .89, .85, .71 and .71 at T1, T2, T3, and T4; alphas = .89, .95, .78, and .88 at T1, T2, T3, and T4; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1999). Experimenters were trained to be enthusiastic (i.e., positive vocalizations throughout the task) while blowing bubbles with the children and practiced with supervisors to ensure quality.

Maternal PE: Mothers' PE was coded from the 3-minute free-play session described above. The same scale used to code child affect was used (ICCs = .82, .90, .89, and .80 at T1, T2, T3, and T4; alphas = .87, .80, .70, and .70 at T1, T2, T3, and T4).

Results

Descriptive and preliminary analyses are presented, followed by relations among child and maternal PE. Then the results from correlations between child and maternal measures, the latent growth curves (LGC), and structural equation models (SEM) analyses are presented. Both types of analyses were needed in order to assess both rank-order and mean-level stability. Single-variable LGC models were run in order to assess the mean-level change in each variable. The rank-order stability in the relations was further examined using SEM; this allowed for the estimation of multiple pathways and relations to other variables in a single analysis. Lastly, moderation by child's sex was examined in LGC and SEM analyses.

Descriptive Statistics and Preliminary Analyses

Means, standard deviations, and ranges of means for the epochs are presented in Table 3. All variables demonstrated acceptable levels of normality (see Curran, West, & Finch, 1996). For each time point, MANOVAs with sex as the independent variable were computed for children's and mothers' PE. Sex differences in the correlations were examined using the Fisher r -to- z transformation formula (Steiger, 1980). There were no significant mean-level or rank-order differences. Parents' education level and mean income at T1 were standardized and averaged to form a measure of socio-economic status (SES). The relations of both SES and maternal age with PE were examined. SES and free-play PE were negatively related for children at T4, $r(166) = -.15, p < .05$, and positively related for mothers at T1, $r(243) = .21, p < .05$. Maternal age was significantly related only to T1 child PE during free play, $r(243) = .13, p < .05$. Because covarying SES or maternal age did not affect the findings, they were not retained.

Relations among Child Measures and Maternal Measures

Correlations among measures of children's and mothers' PE were examined. Children's PE during free play were related across time except between T1 and T2 (see Table 4). Similarly, correlations among measures of children's PE during bubbles were significant. Children's PE during free play and bubbles generally were related within and across time, although there were no significant relations between PE during T1 free play and bubbles at any time or between affect during T1 bubbles and T4 free play. Mothers' PE was correlated across time, $r(165-210) = .22 - .46, ps < .01$, except between T1 and T4, $r(162) = .12, ns$. In summary, there was some evidence of rank-order stability of children's PE and mothers' PE in each context. There also was some support for rank-order stability across the contexts of children's PE.

Growth Curve Trajectories

Mplus 4.2 was used for LGC and SEM analyses (Muthén & Muthén, 1998–2007). For the fit indices, values close to or greater than 0.08 for the standardized root mean residual (SRMR), and .06 or less for the root mean square error of approximation (RMSEA) indicate an adequate fit (see Hu & Bentler, 1999). The manifest variables at each assessment were associated with latent variables (single-indicator, factor loadings fixed at 1). For all LGC models, a model including the intercept and linear slope latent variables with factor loadings fixed at 1 for the latent intercept and 0, 1, 2, and 3 for the latent linear slope for T1, T2, T3, and T4, respectively, was first estimated. For model identification, the means of the manifest variables were fixed at 0 in order for the latent intercept and linear slope means and variances to be estimated (see Bollen & Curran, 2006). If the linear model did not fit, the quadratic slope was added to the model (see Bollen & Curran, 2006; factor loadings were 0, 1, 4, 9, for T1, T2, T3, and T4). If a given model did not fit, using an exploratory framework, either a piecewise approach was used (i.e., freeing an estimate; see Bollen & Curran, 2006) or correlated errors among same measures were added (e.g., mothers' affect at T1 and T2; see Sörbom, 1979). Missing data were estimated using full information maximum likelihood estimation.

The intercept is the average score or status of a variable at T1 (see Table 3). In all analyses, these were significant; thus, the initial status of PE was significantly different from zero (which was expected given the values of the codes). For brevity, the intercepts of the variables are not discussed further. The slope indicated the average trajectory for children across time. Significant variance in the intercept or slope indicated whether children differed in their initial status or slope.

Trajectories of Children's PE

A LGC estimating the means and variances for the intercept and linear slope was specified for children's PE across T1 to T4 free-play interactions. This model did not fit the data; thus, a quadratic factor was added to the model. Results of this model indicated a poor fit and nonsignificant variability in the quadratic slope latent construct (unstandardized estimate [β] = 0.01) and in the linear slope latent construct (β = 0.03). Thus, in accord with standard procedures (e.g., Bollen, 1989; *Mplus* discussion board), both the linear and quadratic slope variances were fixed to 0; this model did not fit the data. Next, the loading on the quadratic latent construct for the fourth time point was allowed to be estimated. This model fit the data well: $\chi^2(2) = 3.07$, *ns*; *RMSEA* = 0.05 (Confidence Interval [90%; CI] = 0.00, 0.14); *SRMR* = 0.03 (see Figure 1). The quadratic slope was significant (β = 0.11, $p < .01$), but the linear slope was not significant (β = 0.05); these results indicated that the curve of the trajectory changed across time and that the rate of change for participants was similar. There was no significant variability in the intercept, β = 0.01; thus, all participants' initial status was similar as well as their trajectories (recall that the linear and quadratic slope variances were set to 0). There was an increase in PE between T1 and T3, and a modest decline between T3 and T4 (see Figure 2). Overall, children's level of PE at T1 was less than their affect at T4.

A similar approach to LGC modeling was used for children's PE during bubbles. The final model included latent constructs of the intercept and linear slope with the loading of the second time point on the linear latent construct freed. This model fit the data well: $\chi^2(4) = 4.55$, *ns*; *RMSEA* = 0.02 (CI = 0.00, 0.10); *SRMR* = 0.05. The slope was significant (β = 0.24, $p < .01$). The variance for the intercept was significant (β = 0.10, $p < .01$) but the variance for the slope was not significant. Thus, there were no individual differences (because the variance of the slope was not significant) in the trajectories but there was variability at T1. Children's PE decreased slightly from T1 to T2 and then increased thereafter (see Figure 2).

Trajectories of Mothers' PE

For mothers' PE during free play, a LGC estimating the intercept and linear slope did not fit the data. The results from a model including a quadratic slope indicated a small negative variance in the quadratic slope (β = -0.01, *ns*); this was fixed at 0. This model fit the data well: $\chi^2(2) = 1.34$, *ns*; *RMSEA* = 0.00 (CI = 0.00, 0.11); *SRMR* = 0.02. The estimated linear and quadratic slopes were significant (β s = -0.47 and 0.11, $ps < .01$); thus, there was mean-level change across time. Specifically, mothers' PE declined from T1 to T3 and slightly increased between T3 and T4 (see Figure 3). The variance for the intercept but not the linear slope was significant (β s = 0.14 and .09, $ps < .05$ and *ns*). Thus, there were no individual differences in the trajectories (i.e., participants followed similar trajectories) but there was variability at T1 (i.e., participants' initial status differed).

Moderation by Child's Sex

For each of the above models, a multiple-groups model was estimated in order to examine differences in the means in intercepts and slopes for girls and boys. In an initial model for each construct, the means for intercept and slope (linear and/or quadratic) factors were set to 0 for boys to test if there was a sex difference in the parameters; girls were estimated relative to boys. Of the three models that were estimated, one model had a significant difference in the slope—the model of children's PE during bubbles. A second multiple-groups model without the constraint of setting the factors for the boys to 0 was estimated so that the values of the slopes could be computed for both girls and boys. Both slopes for girls and boys were significantly positive, but the slope for girls was higher than boys, β s = 0.27 and 0.22, $ps < .01$. These results indicated that girls' and boys' trajectories increased across time but that the change was greater for girls than boys.

Socialization Model of PE

Correlations between Maternal and Child PE

In the free-play context, all of the within-time relations between maternal PE and children's PE were significant (see Table 4). Maternal PE during T2 free play was positively related to children's PE during T4 free play; this was the only significant relation between an earlier measure of maternal PE and a later measure of child PE within free play. However, there were several relations between earlier child and later maternal PE. There were fewer positive relations between mothers' and children's PE across contexts than within the free-play context (see Table 4). Specifically, there was only one significant relation across contexts within time—at T4, children's PE during bubbles was positively related to mothers' free play PE. In terms of the relations across both context and time, children's PE during T1 bubbles was positively related to mothers' PE during T2 and T3 free play.

Free-Play Interactions

Because of the dyadic nature of the free-play context, SEM and growth-to-growth curve analyses were conducted to examine if the trajectory of children's PE was predicted by their mothers' trajectories and vice versa. More specifically, the relations among maternal and children's PE during free play were explored with three socialization SEM analyses—*parent-driven* (predicting children's from mothers' PE), *child-driven* (predicting mothers' from children's PE), and *bidirectional models* (included prediction in both directions across time) were fit to the data. For model identification (because only one indicator was specified for each latent construct), the error variances for parents' and children's PE were fixed at the adjusted reliabilities, $(1 - \text{reliability}) * (\text{variance})$ (see Bollen, 1989). In all models, the across-time paths within a given construct (i.e., autoregressive paths) for mothers' and children's PE were included to control for stability within measures across time. Mothers' PE and children's PE (e.g., T1 maternal and child PE) also were correlated within time. Moderation by child's sex also was examined in these analyses; there were no significant differences.

In the parent-driven model, the initial model did not fit the data; therefore, based on modification indices (which indicate problems in specification; Muthén & Muthén, 1998–2007), a correlation was added between the error variances of mothers' PE at T3 and T4. This model fit the data well: $\chi^2(14) = 20.99$, *ns*; *CFI* = .97; *RMSEA* = .05 (CI = 0.00 – 0.08); *SRMR* = .05 (see Figure 4). All of the autoregressive paths were significant with the exception of a marginal path between T1 and T2 children's PE and all correlations between mothers' and children's PE within time were significant; however, all the paths from mothers' to children's PE were not significant. Similar significant autoregressive paths were found in the child-driven model— $\chi^2(14) = 19.51$, *ns*; *CFI* = .97; *RMSEA* = .04 (CI = 0.00 – 0.08); *SRMR* = .05—and in the bidirectional model— $\chi^2(11) = 19.38$, *ns*; *CFI* = .96; *RMSEA* = .06 (CI = 0.00 – 0.10); *SRMR* = .05. These three nested models were compared using the χ^2 -difference test (Bollen, 1989); there were no significant differences. Another set of SEM analyses was conducted that also included children's PE from bubbles on the latent construct of children's PE. The final bidirectional model (accounting for measurement error) fit the data well: $\chi^2(36) = 50.86$, *ns*; *CFI* = .96, *RMSEA* = .04 (CI .00 – .07), *SRMR* = .07; however, only autoregressive paths were significant predictors of mothers' and children's PE. Thus, it appears that children's PE and mothers' PE at earlier assessments were better predictors of their own than the other's PE at later assessments, although mothers' and children's PE were correlated at each time.

In latent growth-to-growth models, the latent parameters of the growth curve model for mothers' PE during free play were used to predict the latent growth curve parameters of

children's PE during free play or children's PE was used to predict the parameters of mothers' PE. The only significant prediction involved the intercepts. Children's initial PE predicted mothers' initial PE and vice versa, $\beta_s = 0.76$ and 0.23 , $p_s < .05$.

Discussion—In this study, mean-level and rank-order stability in children's and mothers' PE during observed social interactions and the relations between children's and mothers' PE were examined. The situations examined provided unique insight into brief emotional exchanges not only between mothers and children but also between children and non-familial adults. The findings generally were similar regardless of children's sex, maternal age, and SES and there were few relations of SES with key variables.

Developmental Change: Mean-level Changes

The trajectories identified some interesting patterns of mean-level change across four years. Because there was no significant variability in the slopes of the trajectories of PE, children followed similar trajectories in each context. In free play, children's PE gradually increased until 42 months and then declined somewhat at 54 months. For bubbles, children's PE slightly decreased from 18 to 30 months and then increased from 30 to 54 months. When these trajectories were further examined by children's sex, girls and boys followed similar trajectories. Even though girls' average slope was significantly higher than boys' slope in the bubbles context, both slopes were significantly positive (i.e., increasing across time).

Despite some minor fluctuations, in general the patterns indicated a gradual increase in children's PE until at least 42 months, with a modest decline at 54 months in the free-play but not the bubbles context. One reason for the increase in PE could be children's emerging social capacities. Children's PE likely helps to facilitate social interactions (e.g., Lyubomirsky et al., 2005), and children may increasingly use PE for social purposes. In general, PE has the potential to provide children with the opportunity to learn about their surroundings (see Fredrickson, 1998); thus, an increase in PE may be beneficial for development. Furthermore, as children between 18 and 54 months develop better emotion understanding, attention and engagement, and control of social exchanges, they may derive more satisfaction from social interactions.

Overall, the trajectories suggested mean level instability in children's PE. Researchers examining positive emotionality have found fluctuations across the early years of children's lives (Malatesta et al., 1986; Venezia et al., 2004) but stability in later toddlerhood (e.g., Lemery et al., 1999). The curvilinear changes in PE that we found could be due to changes in temperament and also to the nature of the brief measurements—recall, the two contexts reflect more situational than state/trait-like emotionality. Expressivity in these short-duration contexts might be more unstable than dispositional measures.

Another explanation for instability could be the development of children's knowledge and experience with positive emotion-eliciting situations. By 54 months, children are likely better able to play independently and verbally communicate (e.g., emotional vocal cues such as pitch) as opposed to relying solely on facial displays. Researchers have found that as children's verbal communication improves their facial expressivity declines (e.g., Bloom & Tinker, 2001).

Children's PE trajectory declined at 54 months for free play but continued to increase for bubbles; therefore, it is important to consider the differences in the structure of the contexts. In addition to the different female adults (i.e., mother vs. experimenter), another explanation for the differing trajectories is the type of affect likely elicited by the two contexts. In the preschool years, children begin to understand that positive emotions are experienced when

goals are accomplished (see Tronick, 1989). Thus, because there is a clear goal in the bubbles context (experimenter instructed child to pop bubbles) compared to free play, children at 54 months may have expressed affect in response to feeling pride (as a result of successful bubble popping) rather than interest as likely elicited in free play. Another difference between the contexts is that the free-play context tends to elicit more verbal communication with mothers compared to the bubbles context because children focus on popping bubbles and not conversing with the experimenter. Older children may be especially likely to use verbal communication, which could result in a decline in nonverbal PE (see Bloom & Tinker, 2001). More research examining longer durations and different types of PE is necessary to further decipher reasons for the changes.

Mothers' PE during free play gradually declined and the means were relatively low. Perhaps in free play, mothers reacted to the level of children's PE. Mothers may have expressed more affect when their children were relatively young in an effort to try to increase children's PE and expressed less affect later on because their children generally expressed more PE with age. According to Dix (1991), parents often promote their own desired outcomes of a situation. If parents had the goal of making their children happy, they themselves would express more positive emotion in an attempt to elicit PE from their children. This interpretation is consistent with the notion that parents typically play a larger role in modulating children's emotion when they are younger compared to when they are older (see Eisenberg et al., 1998).

Rank-order Stability of PE

Similar to other researchers (Kochanska, 2001; Lemery et al., 1999), there was some rank-order stability in children's PE in each context. Moreover, even though children interacted with different adults (i.e., experimenter during bubbles and mothers during free play), there was some consistency across these contexts, especially at 42 and 54 months, although most of these correlations were small to moderate in size. The pattern of greater consistency at older ages than at 18 months suggests a developmental change. As children have more social experience and develop expectations about social exchanges with adults, their PE may become more consistent across time. Additionally, given mothers' consistency across time in their interactions with their children (see below), by 54 months children should have clear expectations about the nature of this interaction and perhaps have developed stability in dyadic exchanges.

Mothers' PE also exhibited rank-order stability across time. This finding is consistent with the fact that change in adult personality tends to be the exception rather than the rule (see McCrae & Costa, 1990).

Mothers' and Children's PE

Consistent with results from other researchers (see Denham, 1989; Halberstadt et al., 1999), we found positive relations between children's and mothers' PE. During free play, all concurrent relations between mothers' and children's PE were positive and significant, although sometimes low to moderate in strength. Moreover, maternal and child PE were correlated within time in the SEM analyses. The relations in free play were expected given the reciprocal exchanges of affect that likely occurred. These findings are similar to research indicating that mothers' contingently respond to their infants' expressions of joy during play (see Malatesta et al., 1986). In correlational analyses, however, there was unexpectedly only one significant longitudinal relation between an earlier assessment of maternal PE and later assessment of child PE. The results suggest some independence of children's PE from mothers' PE across time, at least in this specific context. This lack of relation may differ from findings in studies of contingent mother-child interaction not only because our study

examined relations across rather than only within time, but also because most children in studies of contingent interactions have been infants rather than toddlers or preschoolers. In the future it would be interesting to examine the contingent responses of affect between mother and child and the sequential effects of emotional displays not only in the free play context but also in other situations.

There was not evidence of mothers' PE predicting children's PE or vice versa in SEM. Thus, the association between maternal and child PE appears to have been relatively established by 18 months and remained fairly stable in rank order over time. Such a pattern of results could be due not only to the partially genetic nature of positive emotionality (Plomin et al., 1993), but also to the stability in emotional exchanges within the same context between mothers and children. It is possible, however, that contingent positive responding between mother and child (which was not examined in this study) changes with age. Furthermore, children likely begin to use additional means to communicate their emotions (e.g., language) other than solely relying on their facial expressions during social interactions (see Bloom & Tinker, 2001).

In the panel models, concurrent correlations between maternal and child PE at 30, 42, and 54 months were found, even when controlling for stability. These within-context relations, however, did not add to prediction across time above and beyond the stability in the constructs. Given that these findings were based on single-indicator models (which can be more prone to misspecification than multiple-indicator models, see Bollen, 1989), more research replicating this pattern is needed before drawing firm conclusions.

Conclusion

Despite the numerous strengths of this study, including the longitudinal design, multiple observed contexts of measurement, and examination of the trajectories of PE, this study had some limitations. Two limitations were that the parents were nearly all mothers and maternal PE was examined in only one context. Thus, assessing only maternal expressivity limits the generalizability of the findings to mothers and conclusions cannot be drawn regarding children's PE in the larger family, social, or cultural contexts. Assessing fathers, siblings, and peers would provide a more holistic picture of the socialization of PE. In addition, there are numerous differences across cultures in regard to the significance of PE (e.g., Eisenberg, Liew, & Pidada, 2001). The results in this study are likely specific to this culture and need to be examined in other cultures. Lastly, even though the observational data in this study of children's PE were unique because they involved two social contexts, these contexts were only brief interactions. Thus, some of the instability in PE could be accounted for by the nature of these assessments.

The findings suggest that not only does children's PE have a dispositional quality, but also that it changes in mean level with age and varies as a function of the affect of their social partners. Children whose PE is more frequent are more likely to get along with peers (Denham, McKinley, Couchoud, & Holt, 1990) and early interactions with mothers may set the stage for their positive emotionality. Moreover, the modest stability in children's PE across interaction partners suggests that socialization of PE at home may affect the quality of their interactions with other people. Lastly, the finding that children's and mothers' PE did not longitudinally predict one another's PE in panel models suggests that either children's and mothers' PE do not affect one another across time beyond a specific interactional context or that any causal relations between mothers' and young children's PE across time are established early in the relationship (before 18 months) and are simply stable across time.

Acknowledgments

This research was supported by a grant from the National Institute of Mental Health awarded to Nancy Eisenberg and Tracy L. Spinrad. We express our appreciation to the families who participated in the study and to the many research assistants who contributed to this project. We also thank our project director, Anne Kupfer, and the numerous graduate students who have assisted with this project.

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Figure 1. Latent growth curve model of children's PE during free play

Note: FP-C = Free play child positive expressivity; Var = variance. The correlations among the latent constructs were not significant. $\chi^2(2) = 3.07$, *ns*; *RMSEA* = .05 (CI = 0.00, 0.14); *SRMR* = .03.

Figure 2. Trajectories of children's PE

Note: For free play, the predicted values were 1.31, 1.47, 1.85, and 1.65 at 18, 30, 42, and 54 months; the R^2 statistics were .08, .16, .29, and .24. For bubbles, the predicted values were 1.88, 1.84, 2.36, and 2.60, at 18, 30, 42, and 54 months; the R^2 statistics were .22, .28, .49, and .35.

Figure 3. Trajectories of maternal PE

Note: The predicted values were 2.22, 1.86, 1.72, and 1.80 at 18, 30, 42, and 54 months; the R^2 statistics were .39, .38, .54, and .26.

Figure 4. Parent-driven model of PE during free play

Note: Solid lines = significant paths, $p < .05$; Dotted lines = marginal paths; Dashed lines = non-significant paths. Unstandardized estimates are presented first and completely standardized estimates are presented in parentheses. $\chi^2(14) = 20.99$, ns ; $CFI = .97$; $RMSEA = .05$ ($CI = 0.00, 0.08$); $SRMR = .05$.

Table 1

Summary of Reviewed Longitudinal Studies of Rank-order and Mean-level Stability

	Measure	Ages of Children	Rank-order	Mean-level
Child Studies				
Denham et al. (1995)	reported	6w, 4m, 9m, 19m, 30m	stability	increase
Kochanska (2001)	observed	9m, 14m, 22m, 33m	stability	n/a
Kochanska et al. (2007)	observed	9m, 14m, 22m, 33m, 45m	some stability	n/a
Kochanska et al. (2007)	observed	7m, 15m, 25m, 38m, 52m	some stability	n/a
Lavelli & Fogel (2005)	observed	weekly from 3w to 14w	n/a	increase then stability
Lemery et al. (1999)	reported	3m, 6m, 12m	stability	n/a
Malatesta et al. (1986)	observed	2.5m, 5m, 7.5m	n/a	increase
Mother Studies				
Biringen et al. (1999)	observed	9.5m, 12m, 14m	stability	stability then decrease
Dunn et al. (1996)	observed	33m, 69m	n/a	stability
Eisenberg et al. (2003)	observed & reported	6y, 8y	stability	n/a
Eisenberg et al. (2005)	observed	9.3y, 11.4y, 13.4y	stability	n/a
Izard et al. (1991)	reported	2.5m, 4.5m, 6m	stability	n/a
Izard et al. (1993)	reported	2.5m, 4.5m, 6m, 13m, 18m, 24m, 36m	stability	n/a
Kaye & Fogel (1980)	observed	6w, 13w, 26w	no stability	stability; increase (conditional)
Robinson et al. (1993)	observed	18m, 24m	n/a	decrease
Valiente et al. (2006)	reported	6.5–10y, 8.5–12y, 10.5–14y	stability	n/a

Note: w = week; m = month; y = year; n/a = not assessed

Table 2**Demographic Variables**

	18-month visit (T1) (N = 247; M = 17.79 months, SD = 0.52)	30-month visit (T2) (N = 216; M = 29.77 months, SD = 0.65)	42-month visit (T3) (N = 192; M = 41.75 months, SD = 0.65)	54-month visit (T4) (N = 168; M = 53.89 months, SD = 0.80)
Mother education	Grade school = 2	Grade school = 2	Grade school = 2	Grade school = 2
	Some high school = 14	Some high school = 12	Some high school = 11	Some high school = 9
	High school grad = 46	High school grad = 36	High school grad = 32	High school grad = 27
	Some college = 72	Some college = 68	Some college = 63	Some college = 56
	College grad = 94	College grad = 80	College grad = 68	College grad = 59
	Graduate school = 17	Graduate school = 16	Graduate school = 14	Graduate school = 13
	Not reported = 2	Not reported = 2	Not reported = 2	Not reported = 2
Mother race	Caucasian = 224	Caucasian = 197	Caucasian = 173	Caucasian = 153
	African American = 9	African American = 8	African American = 9	African American = 8
	Asian = 4	Asian = 4	Asian = 3	Asian = 2
	Native American = 5	Native American = 4	Native American = 4	Native American = 4
	Other = 2	Other = 1	Other = 1	Other = 0
	Mix of 2 races = 2	Mix of 2 races = 2	Mix of 2 races = 2	Mix of 2 races = 1
Mother ethnicity	Not reported = 1			
	Not Hispanic/Latina = 204	Not Hispanic/Latina = 178	Not Hispanic/Latina = 159	Not Hispanic/Latina = 141
	Hispanic/Latina = 42	Hispanic/Latina = 38	Hispanic/Latina = 33	Hispanic/Latina = 27
Child's sex	Not reported = 1			
	Boys = 137	Boys = 119	Boys = 104	Boys = 89
Child race	Girls = 110	Girls = 97	Girls = 88	Girls = 79
	Caucasian = 215	Caucasian = 186	Caucasian = 164	Caucasian = 143
Child ethnicity	African American = 6	African American = 7	African American = 7	African American = 7
	Asian = 2	Asian = 2	Asian = 2	Asian = 1
	Native American = 6	Native American = 5	Native American = 5	Native American = 5
	Other = 18	Other = 16	Other = 14	Other = 12
Family income	Not Hispanic/Latino = 213	Not Hispanic/Latino = 186	Not Hispanic/Latino = 167	Not Hispanic/Latino = 147
	Hispanic/Latino = 33	Hispanic/Latino = 29	Hispanic/Latino = 25	Hispanic/Latino = 21
	Not reported = 1	Not reported = 1		
SES	Less than \$ 15k = 12	Less than \$ 15k = 16	Less than \$ 15k = 9	Less than \$ 15k = 5
	\$15–30k = 34	\$15–30k = 28	\$15–30k = 20	\$15–30k = 19
	\$30–45k = 44	\$30–45k = 36	\$30–45k = 25	\$30–45k = 19
	\$45–60 = 46	\$45–60 = 38	\$45–60 = 40	\$45–60 = 33
	\$60–75k = 31	\$60–75k = 30	\$60–75k = 15	\$60–75k = 17
	\$75–100k = 28	\$75–100k = 30	\$75–100k = 22	\$75–100k = 24
	over \$100k = 26	over \$100k = 28	over \$100k = 30	over \$100k = 32
	Not reported = 26	Not reported = 10	Not reported = 31	Not reported = 19
SES	M = -0.002 (.88)	M = -0.03 (.90)	M = 0.02 (.86)	M = 0.04 (.86)

Table 3

Means and Standard Deviations of Measures for Total Sample.

	N	M	SD	Skew	Kurtosis	Range of Ms and Epoch		N	M	SD	Skew	Kurtosis	Range of Ms and Trial	
						Minimum	Maximum						Minimum	Maximum
Child														
Free play														
18-mo.	245	1.32	.39	2.03	4.88	1.20 (1)	1.34 (7, 10)	245	2.23	.66	0.35	-0.64	2.12 (9)	2.41 (1)
30-mo.	216	1.47	.46	1.56	2.83	1.38 (10)	1.58 (11)	216	1.85	.54	0.58	0.13	1.78 (8)	1.98 (1)
42-mo.	192	1.86	.51	0.21	-0.80	1.76 (3)	1.97 (12)	192	1.76	.50	0.55	0.28	1.67 (4)	1.86 (1)
54-mo.	168	1.64	.51	1.04	0.78	1.49 (12)	1.76 (4)	168	1.84	.53	0.53	-0.34	1.73 (11)	1.95 (4, 6)
Bubbles														
18-mo.	245	1.88	.65	0.42	-0.63	1.66 (1)	2.04 (12)							
30-mo.	216	1.84	.61	0.41	-0.67	1.79 (12)	1.94 (1)							
42-mo.	192	2.37	.53	-0.69	0.10	2.31 (12)	2.64 (1)							
54-mo.	168	2.56	.72	-0.27	-0.50	2.41 (12)	2.70 (7)							

Note: For all measures, the range for each epoch mean was 1 – 4. The epoch number (i.e., specific interval during a task) is in parentheses. If two epoch numbers are reported, then both epochs had the same mean. Mo. = months.

Table 4

Correlations among All Measures.

	1	2	3	4	5	6	7	8	9	10	11
1. 18-mo. C free play	--										
2. 30-mo. C free play	.11 (210)	--									
3. 42-mo. C free play	.17* (185)	.29** (188)	--								
4. 54-mo. C free play	.23** (162)	.15* (166)	.26** (165)	--							
5. 18-mo. C bubbles	.07 (241)	.23** (208)	.24** (183)	.12 (160)	--						
6. 30-mo. C bubbles	.01 (210)	.33* (214)	.36** (188)	.22** (166)	.25** (208)	--					
7. 42-mo. C bubbles	.06 (186)	.17* (188)	.39** (190)	.16* (165)	.17* (183)	.36** (188)	--				
8. 54-mo. C bubbles	.05 (162)	.19* (166)	.19* (165)	.44** (166)	.21** (160)	.28** (166)	.40** (165)	--			
9. 18-mo. M free play	.30** (243)	.05 (210)	.06 (185)	.00 (162)	.09 (241)	.01 (210)	.12 (185)	-.02 (162)	--		
10. 30-mo. M free play	.10 (210)	.35** (214)	.08 (188)	.18* (166)	.14* (208)	.10 (214)	.03 (188)	.12 (166)	.28** (210)	--	
11. 42-mo. M free play	.08 (185)	.20* (188)	.31** (190)	.09 (165)	.20** (183)	.07 (188)	.04 (190)	.02 (165)	.22** (185)	.42** (188)	--
12. 54-mo. M free play	.07 (162)	.15* (166)	.21** (165)	.29** (166)	.15+ (160)	.01 (166)	.04 (165)	.15* (166)	.12 (162)	.42** (166)	.46** (165)

Note: Degrees of freedom in parentheses

*
 $p < .05$;**
 $p < .01$.

Mo. = months; C = child; M = mother.