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Longitudinal Relations Among Language Skills, Anger Expression, and Regulatory Strategies in Early Childhood

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Abstract

Researchers have suggested that as children's language skill develops in early childhood, it comes to help children regulate their emotions (Cole, Armstrong, & Pemberton, 2010; Kopp, 1989), but the pathways by which this occurs have not been studied empirically. In a longitudinal study of 120 children from 18 to 48 months of age, associations among child language skill, observed anger expression, and regulatory strategies during a delay task were examined. Toddlers with better language skill, and whose language skill increased more over time, appeared less angry at 48 months and their anger declined more over time. Two regulatory strategies, support-seeking and distraction, explained a portion of the variance in the association between language skill and anger expression by 36 months.

Keywords

emotional development; language development; emotion regulation; emotions; early childhood

Emotion regulation, defined as processes that contribute to the monitoring, evaluating, and modifying of emotional reactions (Thompson, 1994), is broadly regarded as critical to children's socio-emotional competence and mental health. In toddlerhood, quick, intense, and sustained angry reactions are typical of toddlers' tantrums (Potegal, Kosorok, & Davidson, 2006). However, when preschool and school age children have frequent angry reactions that are quick, intense, or sustained, they are viewed as emotionally dysregulated or as having behavior problems (Cole, Zahn-Waxler, & Smith, 1994; Shaw, Bell, & Gilliom, 2000). Thus, the transition from toddlerhood to preschool age in which angry reactions typically decrease in frequency, immediacy, duration, and intensity (Bridges, 1932; Cole et al., 2011) can be viewed as crucial to emotional development.

This developmental decline in anger reactivity coincides with other changes that should contribute to children's ability to self-regulate. By the third year children are thought to draw on new cognitive and linguistic skills to regulate emotions (Kopp, 1989). From this perspective, self-regulation is defined by a child's ability to initiate regulatory strategies in the absence of adult instruction (Kopp, 1982). It is commonly assumed that language development contributes to the development of self-regulation although this premise has not been studied to the degree that attention control has been. Although there is no overarching theory that has specified the varied ways that language might contribute to self-regulation of anger, language skills arguably enhance a child's ability to express needs with words rather than with emotion, to think before acting in a frustrating situation, and to generate and

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sustain ideas that serve attention control (Cole, Armstrong, & Pemberton, 2010). That is, young children who acquire language quickly and well should be able to think about rules (“Mommy said wait”), to communicate needs calmly (language mitigates the need to express needs nonverbally), and, when needed, to sustain a shift of attention rather than focus on something they cannot have (language enriches the content of the activities, such as pretend play, that distract the child from the desired object or activity).

Language develops rapidly between the first birthday and preschool age (Gleason, 2005) in parallel with the normative decline in quick, intense and prolonged angry reactions and the development of regulatory strategies. Several lines of research suggest these two domains are linked. First, child language delays and behavior problems, especially those involving poorly regulated anger, are associated (Baker & Cantwell, 1992; Cohen & Mendez, 2009; Irwin, Carter, & Briggs-Gowan, 2002). Second, child use of emotion language predicts their socio-emotional competence (e.g., Dunn, Bretherton, & Munn, 1987; Denham et al., 2003; Fabes, Eisenberg, Hanish, & Spinrad, 2001). Third, children’s self-directed speech can guide their actions (Berk, 1992; Luria, 1961; Winsler & Naglieri, 2003; Vygotsky, 1962). Fourth, preschool interventions that teach children to use words to deal with frustration improve their socio-emotional competence (Domitrovich, Cortes, & Greenberg, 2007; Izard et al., 2008).

In addition to language skill, a child’s disposition or temperament is associated with the development of emotion regulation. For example, effortful control or the ability to shift attention and inhibit a prepotent response contributes to a child’s ability to modulate negative emotional reactions (Kochanska, Murray, & Harlan, 2000; Rothbart, Ellis, Rueda, & Posner, 2003). Between 24 and 36 months, children are first observed to engage in effortful control of their behavior when frustrated (e.g., Calkins, Gill, Johnson, & Smith, 1999; Feldman, 2009), albeit with limited effectiveness (Buss & Goldsmith, 1998). Thus far, effortful control has mainly been attributed to the development of attention control (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Sethi, Mischel, Aber, Shoda, & Rodriguez, 2000). For example, when young children are required to wait for a reward, those who shift their attention away from the reward and focus on another activity appear less angry than children who do not distract themselves in this way. This use of distraction is regarded as an important self-regulatory strategy for decreasing anger expression in a reward delay situation (Cole et al., 2011). As effortful control is also related to a child’s language ability (Blair & Razza, 2007), we controlled for it in this study of developmental links among children’s language skills, anger expressions, and strategy use.

Direct evidence for relations among growth in language skills, decline in anger reactivity, and increase in self-regulatory strategy use is limited. Preschoolers’ verbal skills are related concurrently to their expressions of positive emotions and their social competence (Cassidy, Werner, Rourke, Zubernis, & Balaram, 2003). In terms of longitudinal evidence, toddler verbal skills predicted children’s behavior during a later mental development test (Ayoub, Vallotton, & Mastergeorge, 2011). Vocabulary size at age 24 months, above and beyond general cognitive skill, predicted the level and rate of change in self-regulation from ages 14 to 36 months for boys and the level at each age for girls (Vallotton & Ayoub, 2011). These findings support the premise that early language development influences self-regulation, but their assessment of self-regulation was limited to behavior during the administration of the Bayley Scales, a task that is not designed to tax self-regulation specifically. Moreover, the findings underscore the need to consider cognitive skill and gender when assessing the relations between language and self-regulation. To further understand these relations we chose to examine the degree to which language skills predicted changes in the immediacy, intensity, and duration of young children’s angry reactions, the degree to which changes were associated with child-initiated regulatory strategies, and whether these strategies had a stronger link to reduced anger at certain ages. In early stages of language learning, such as first words and vocabulary spurt, children may be unable to integrate verbal and emotional expression (Bloom, 2003). At later ages, however, we assume that they can more readily rely on words instead of nonverbal emotional expressions to convey their needs, which is the premise of several interventions for promoting preschoolers' emotional competence (Domitrovich et al., 2007; Izard et al., 2008). Kopp (1989) suggested that the ability to draw on language in the toddler years, the period of heightened anger reactivity, should contribute to the decline in anger reactivity because children can draw on language skills to regulate anger. Conversely, children who express less anger as toddlers may receive more language input because they are easier conversation partners for parents (Stern, 1985). Linking language development to emotional development in these various ways is consistent with the growing understanding of the development of the brain's role in the integration of domains of psychological functioning (Gunnar & Quevedo, 2007; Johnson & Munakata, 2005).

In sum, in addition to appreciating the importance of effortful control to the development of self-regulation, it is necessary to test the premise that a child's language ability, conceptualized either as an individual difference or in terms of intra-individual growth, contributes to the development of anger regulation in early childhood. The purpose of the present study was to investigate the contributions of early language development, over and above effortful control, gender, and intellectual ability in predicting a) the normative decline in anger expressions and b) the use of regulatory strategies (child-initiated support-seeking and distractions).

Based on the framework described by Cole and colleagues (2010), we predicted that a) better language skills and language skills that increase at a greater rate over time would predict a developmental decrease in anger expressions, b) better language skills would predict use of support-seeking to mother because language allows children to specify needs through words rather than affect, c) better language skills would predict quicker and longer distractions because language should enrich the focus of redirected attention, and d) toddler age language skills should have a prospective rather than concurrent influence on anger regulation because the influence of language should occur once children's language development is more established in early preschool, rather than in early language learning. The present study tested the prediction that language status influenced developmental changes in anger expressions between ages 24 and 48 months during a situation designed to frustrate young children, and that this relation was at least partly explained by the quality of young children's regulatory strategies.

Method

Participants

A multi stage strategy was used to recruit rural and semi-rural families whose incomes were below the national median income but above the national poverty threshold. This strategy allowed variation in income, which is associated with SES (Hart & Risley, 1994), without the many confounding influences of poverty or above average economic advantage. In addition to public advertisements in targeted census tracts, letters were sent to families in those communities with children in the recruitment age, identified through birth announcements.

The aim of recruitment was to enroll 125 families based on power analysis. Using this recruitment strategy, 128 families enrolled; 124 were income eligible at Time 1 when the child was 18 months old. At 48 months, 120 families remained enrolled (65 boys), a retention rate of 96.8% that we attribute to our efforts and to the values of the participating families. Withdrawn families did not differ from those who completed on any demographic characteristic. Children were seen within two weeks of their half or full birthday at four age points; M age in months at each time were 18.44 (SD = .57), 24.39 (SD = 1.3), 36.44 (SD = .80) and 48.33 (SD = .67) months. Most (93.3%) children were identified as White by their mothers; 6.7% were biracial. Including all sources of income, the average household annual income when the child was age 18 months was $40,502.94 (SD=14,480.727).

Procedures

Observations and questionnaires were conducted at four home visits (at child age 18, 30, 36, and 42 months) and four lab visits (18, 24, 36, and 48 months). Each lab visit varied somewhat due to child age but always included an alternating series of tasks to elicit anger (Goldsmith, Reilly, Lemery, Longley, & Prescott, 1993; Cole et al., 2003) and standard relief tasks such as free play. Only the lab task used to assess child anger and child-initiated regulatory strategies is described in detail. Home observations were 90–120-minute visits, conducted by trained research assistants, and scheduled for a time when most family members would be present and they were encouraged to do as they would normally. Observers limited their interactions with family members and no specific instructions that constrained family interactions and activities were given. Video recording was not used based on prior experience that cameras distracted toddlers from their normal routines more than observers did.

Speech sample collection—The home observer used a digital audio recorder to record naturally occurring speech samples. In addition, the observer conducted four 10-minute observations of family interaction; the ratings from these observations were not included in the present study. The audio-recorded speech samples were subsequently transcribed by trained research assistants using the CHILDES system (MacWhinney, 2000). To derive scores for these speech samples, two or more 10-minute epochs were transcribed in order to reach 50 child utterances per epoch. A graduate student trained in CLAN supervised transcription and checked 100% of the narratives for formatting accuracy and 20% for content accuracy.

Anger expression and regulatory strategies—Child anger expressions and regulatory strategies were observed during a boring 8-minute wait, often used to observe child self-regulation (Dennis, 2006; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). Each mother was instructed to tell her child that the child must wait to open a gift until she finished her work (adapted from Vaughn, Kopp, & Krakow, 1984). Waiting is frustrating for typical children in the ages studied (e.g., Cole, Teti, & Zahn-Waxler, 2003; Cole et al., 2011). The task was administered in the following manner at each age point. First, mothers were briefed in advance to avoid mothers laughing and in that way inadvertently inserting humor into a frustrating situation for the child. First, the RA gave the mother “work” (questionnaires) and the child a boring toy: a flat rubber “lilypad” (18 months), one of a pair of cloth cymbals (24 months), a small toy car with missing wheels (36 months), and a toy horse with missing legs (48 months). Then the RA placed a shiny gift-wrapped bag, tied tightly with a ribbon, on the child’s table, saying “This is a surprise for you.” As the RA left, the mother told the child to wait until she finished her work to open the gift. After 8 minutes, the RA returned and the mother let the child open the gift.

Coding Systems

Two independent coding systems generated data for this study. The first system involved a time-sensitive assessment of emotion expressions. The second system involved an independent but time-linked assessment of several behaviors, including regulatory strategies.

For each system, a different coding team was trained to 80% accuracy with master coders; once trained, 15% of cases were checked for reliability at random times.

Anger expressions—To determine the total amount of anger displayed and its temporal qualities, we coded emotion expressions in 15-second epochs in all challenging tasks. For the present study, we only report data from the boring wait. At 8 minutes long, it provides a lengthier behavioral record than the other tasks. In addition, it was the only task that was used at all four ages. The focus of this study was on anger, but we also recorded neutral, non-angry periods in which the child was either happy or neutral. Each emotion was coded in terms of its presence and intensity (except neutral) in each 15-second epoch. We inferred emotion expressions from facial (brow and mouth movements), vocal, and select postural or gestural cues (Cole, Zahn-Waxler, & Smith, 1994). For example, anger was coded if the brow was furrowed, the jaw clenched or set, lips were pressed, vocalizations conveyed protest, irritation, or fussiness, and the body appeared restless, squirmy, with agitated arm and leg movements. Across ages, the average κ for emotion = .88 (range .81 – .94). For analyses, we created the following variables for anger: average intensity of bout of anger, latency to first bout, and average bout duration. The number of anger bouts at each age were 3.50 (SD = 1.91), 3.13 (SD = 2.20), and 1.68 (SD = 1.95) at 24, 36, and 48 months, respectively. More details about the developmental changes in anger are included in another manuscript (Cole et al., 2011), but the numbers suggest that children were frustrated by this task at all ages and that changes in this expression of anger over time in response to the boring wait warrants investigation.

Regulatory behavior—In the same 15-second epochs, an independent team coded 10 child behaviors typically studied in emotion regulation studies. For the present study, we focused on two: (1) support-seeking bids to mother about the challenge (e.g., "Mom, are you almost done?" or "I wonder what's in it"), and (2) distraction, which was further distinguished as either (a) focused, i.e. child became absorbed in alternative activity (e.g., making silly faces in the one-way mirror) or (b) unfocused, i.e. child diverted attention from focus on challenge but did not become absorbed in an alternative activity. Each behavior was classified as child-initiated, mother-initiated (and child complied), or disruptive. For the present study, only non-disruptive, child-initiated behaviors were examined. In addition, we only included *calm* support-seeking to mother about the challenge because these bids were not disruptive and could arguably be regarded as appropriate regulatory strategies (Gilliom et al., 2002). The average kappa across ages was κ = .82 (range .73 – .91.). We analyzed total time, bout frequency, latency to first bout, and average bout duration for each code. For these analyses, latency to the first and duration of support-seeking and latency and duration of focused distractions were included.

Language

Spontaneous sampling procedures—Linguistic complexity was assessed using spontaneous sampling procedures (e.g., Miller, 1981), which captured unconstrained speech during natural interactions between parent and child in the home or during the unstructured free play, reading task, and clean-up task in the laboratory. The index of linguistic complexity derived from transcriptions of this natural speech was the Mean Length of Utterance (MLU). The MLU is a measure of syntactic complexity, first introduced by Brown (1973), and is computed as the average number of morphemes in a child's utterances. Morphemes include each word in the sentence (including repetitions), as well as affixes or grammatical inflections such as *un-, -s, -ed*. Each morpheme represents linguistic knowledge, and thus children with similar number of morphemes per utterance are thought to have language at the same level of complexity or maturity (Gleason, 2005). MLU begins to lose value as an index of language development at around the fourth year and thus is not used as an index of complexity after 36 months of age.

Speech samples were transcribed from home visits when the child was 18 months and 30 months of age and in the lab when the child was 24 and 36 months. Previous research has shown MLU to be reliable across home and laboratory settings at 24 months (Bornstein, Haynes, Painter, & Genevro, 2000). Moreover, for the sample being used in this study, MLU was reliable across settings, as evidenced by a significant relation between the 30 month home visit and 36 month lab visit, suggesting that MLU is related across setting and time for these ages, $r(99) = .52$, $p < .001$. The mean length of utterance (MLU) for each child was calculated using CLAN, a language analysis software package (MacWhinney, 2000).

Laboratory tasks assessing language

MCDI: The MacArthur Communicative Development Inventory – Words and Gestures (MCDI; Fenson et al., 1993) was administered at 18 months. The MCDI is an 889- item form on which mothers indicate how many gestures, words, and phrases the child understands and uses. Although the children were 18 months of age, the Words and Gesture form, which is normed up to 16 months of age, was used. We used this form of the MCDI because the version for older children was normed on children from advantaged households, unlike the children from homes that are economically strained. Because the MCDI – Words and Gestures was not normed for 18-month-olds, only the raw scores for words understood and words produced were used in the analysis (alphas of .95 and .96, respectively).

CELF-3: The Grammatical Understanding standard score from the Clinical Evaluation of Language Fundamentals 3 (CELF-3; Semel et al., 1995) was administered at the 36 month lab visit.

TOLD-P:3: The Sentence Imitation and Syntactic Understanding scores from the Test of Language Development-Primary Third Edition (TOLD-P3; Newcomer & Hammill, 1997) was administered at the 48 month lab visit.

Covariates

Child gender—Boys were coded as 0 and girls as 1.

Effortful control—Child temperament was assessed annually by mother report. For this study, the Toddler Behavior Questionnaire (TBAQ-R; Goldsmith, 1996) effortful control scale, defined by 5 of the TBAQ-R's 14 subscales, was used. The effortful control scale comprises inhibitory control, attention shifting, low-intensity pleasure, perceptual sensitivity, and attention focusing, but preliminary analysis for this sample indicated that perceptual sensitivity and low-intensity pleasure had inadequate internal consistencies. We removed them and use an effortful control scale with Cronbach's alpha of 0.82.

WPPSI performance IQ—Children's intellectual status was assessed at 36 and 48 months during laboratory visits with the Wechsler Preschool and Primary Scale of Intelligence-III (WPPSI-III; Wechsler, 2002). The Performance IQ (Block Design and Object Assembly subtests), a composite of 36 and 48 months ($r = .44$, $p < .01$), was used as an index of general intellectual functioning to avoid shared variance between language skills and Verbal IQ. The correlations of Performance IQ and Full Scale IQ for the sample were 0.87 at 36 months and 0.80 at 48 months.

Income-to-needs ratio—The income-to-needs ratio (INR) is an index of household income relative to national norms. A middle income family has an INR of 3.0, and by definition, an INR of 1.0 indicates household income represents poverty. The M INR was 2.37 (SD = 0.94), indicating households ranged between poverty and middle income.

Results

Descriptive Data and Overview of Analyses

The means and standard deviations for variables used in data analyses are presented in Tables 1 (language status indices) and 2 (anger expression, support-seeking, and distraction). Log transformations were used to improve skewed distributions of anger expression and regulatory behaviors. Descriptive statistics and zero order correlations were conducted in SPSS 18.0.

To examine how levels and change in language skill influenced levels and change in anger expression, linear growth of each construct was modeled using LISREL 8.80 (Jöreskog & Sörbom, 1996). Structural equation models were executed with covariance matrices of observed variables, using THEIL (Molenaar, 1996), a FORTRAN program for robust covariance matrix estimation. It improves the condition of a covariance matrix and handles missing data using the maximum likelihood estimate while leaving its underlying structure intact.

Analyses first examined whether a) the initial level and change of language skill influences the end level and change of anger expression (see Figure 1), or b) the initial level and change of anger expression influences the end level and change of language skill. In the presence of significant associations, we next tested whether the pathways could be partially associated with support-seeking and focused distractions. In order to understand at what time the strategies most mattered, we looked at each assessment as an independent predictor (see Figure 2). In all models, child gender, child effortful control, child Performance IQ, and Income-to-Needs Ratio were included as covariates. Covariates were entered into the model as predictors of both predictor and outcome initial level and growth variables. Nonsignificant covariates were systematically removed to improve power, whereas marginal and significant covariates were included in the final model.

Model Fit

Model fit was assessed using the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Normal Theory Weighted Least Squares Chi-Square (χ^2). The RMSEA index includes adjustments for model complexity and is less influenced by the number of parameters in the model than other indicators of fit. The CFI compares the covariance matrices predicted by the model to the observed covariance matrix, and compares the null model with the observed covariance matrix. Like RMSEA, CFI is among the measures least affected by sample size (Fan, Thompson, & Wang, 1999). For RMSEA, a value less than .05 is considered a good fit, and below .08 an adequate fit (Kline, 2004). By convention, the CFI should be equal to or greater than .90 to accept the model. Chi-square is influenced by sample size and indicates good fit when $p > .05$.

Composites

Associations between growth models for both child language skill and anger expression were examined using composites of each construct created at three ages: 24, 36, and 48 months. Variables in the Language Skill composite changed across ages to reflect important elements of developmental change in language skills (vocabulary size, MLU, receptive and expressive grammatical understanding). The toddler age Language composite included vocabulary size (receptive and expressive based on the MCDI) at 18 months and natural speech MLU at 18 and 24 months, and the early preschool age composite included natural speech MLU at 30 and 36 months and receptive grammar at 36 months. We refer to these as 24 and 36 month composites for ease of reading. We took this approach in order to generate a robust index of child language skill at each age for that 6-month period. This avoided basing estimates of language skill on a single index, especially one such as MLU, which could vary across child mood and situational context. Finally, at 48 months, preschool age, we used a developmentally appropriate test of receptive and expressive language, the TOLD Syntactic Understanding and Sentence Imitation subtests. MLU is a less sensitive index of language skill by this age. Anger Expression composites included latency to the first bout, duration, and intensity of anger expressions at each age.

Composites were created by standardizing each measure into a Z-score and then summing the standardized variables. Language measures were generally moderately correlated at each age (24 months, *r*s = .06 – .58; 36 months, *r*s = .12 – .53; and 48 months, $r = .31$; See Table 3). Not unexpectedly, standardized measures were more highly correlated with other standardized measures than with MLU. The lowest correlations were between those measures without shared method variance. We hope that by including both types of measures, we are including the most accurate picture of children's language skill as possible and including several different constructs within language development. Anger expression variables were significantly correlated with each other at each age (24 months, *r*s = .39 – .67; 36 months, *r*s = .57 – .86; and 48 months, *r*s = .61 – .92).

Initial Level and Change in Language Skill Predicting End Level and Change in Anger Expression

In this model, the initial level at 24 months and change in Language Skill from 24 to 48 months were tested as predictors of the end level at 48 months and change in Anger Expression. Growth models of language skill and anger expression each indicated that variance estimates of level and slope were significant ($p < .05$). After first testing the model with all possible paths (Figure 1), nonsignificant paths were systematically removed. The trimmed model and its standardized betas are presented in Figure 3. Please note that while some standardized betas are larger than 1, this does not indicate an error. Unlike in classical exploratory factor analysis where factors are standardized and uncorrelated, if the factors are correlated, the factor loadings are regression coefficients and not correlations and can be larger than one in magnitude (Jöreskog, 1999). It may indicate a degree of multicollinearity in the data, which would not be unexpected in this model where we have related constructs of both initial level and growth all in one model. The tested model was an excellent fit by all measures (RMSEA = 0.0; CFI = 1.0; χ^2 (26) = 25.07, $p > .05$). Language Skill initial level predicted Anger Expression end level ($\beta = -.72$, $p < .05$) and change in Anger Expression over time ($\beta = -1.02$, $p < .05$). Language Skill change over time predicted Anger Expression end level ($\beta = -.80$, $p < .05$) and change in Anger Expression over time ($\beta = -1.29$, $p < .05$). Language Skill level and slope were negatively correlated ($r = -.63$, $p < .05$), and the relation between Anger Expression level and slope was not significant.

Initial Level and Change in Anger Expression Predicting End Level and Change in Language Skill

To determine whether an alternative path between early language skills and change in anger expression could be shown, i.e. early anger expression predicting language skills, a reverse model was built. That is, the initial level at 24 months and change in Anger Expression from 24 to 48 months were tested as predictors of the end level at 48 months and change in Language Skill. The trimmed model was an excellent fit (see Figure 4, RMSEA = 0.0044; CFI = 0.99; χ^2 (28) = 28.06, $p > .05$). However the reverse paths did not reach the $p < .05$

level of significance. There were trends for Anger Expression change over time to predict to both Language Skill end level ($\beta = -.42$, $p < .10$) and change in Language Skill over time ($\beta = -.45$, $p < .10$). Neither Language Skill level and slope nor Anger Expression level and slope were significantly correlated. Therefore, we concluded that language skill was a stronger predictor of anger expression across toddlerhood than was the reverse hypothesis. Our next steps were to examine whether each of two specific regulatory strategies—support-seeking and distraction—could contribute to the pathway between language and the decline in anger expression.

Support-Seeking as a Factor in the Path between Language Skill and Anger Expression

The latency to and duration of support-seeking to mother adequately loaded as a single latent Support-Seeking factor, which was used at each age (range of loadings = −.46 to 1.0, all significant). After first testing the model with all possible paths (as seen in Figure 2), nonsignificant paths were systematically removed. The trimmed model is presented with standardized betas (Figure 5) and was an adequate fit by most measures (RMSEA = 0.05; CFI = 0.93; χ^2 (94) = 122.30, $p = .027$). There was moderate stability in Support-Seeking across time (βs = .29 and .25, respectively, both *p*s < .05). A steeper increase in Language Skill across time was associated with quicker and longer support-seeking to mother at 36 months. Support-Seeking at 24 months was associated with an increase of Anger Expression across toddlerhood ($\beta = .32$, $p < .05$) but support-Seeking at 36 months was associated with a lower end level of Anger Expression ($\beta = -.72$, $p < .05$) and a decrease in Anger Expression across time ($\beta = -.97$, $p < .05$).

Distraction as a Factor in the Path between Language Skill and Anger Expression

Latency to and average duration of distractions did not load as a single latent factor. Although being able to quickly distract in the context of waiting is important (Cole et al., 2011), the longer a child can sustain a distraction the less likely the child will become frustrated again. Therefore, we used distraction duration in this model.

The trimmed model was an adequate fit by most measures (Figure 6, RMSEA = 0.067; CFI = 0.90; χ^2 (51) = 78.40, $p = .0081$). Higher initial levels of Language Skill were associated with longer distractions at 36 months ($\beta = .69$, $p < .05$), as was steeper increase in slope in Language Skill ($\beta = .98$, $p < .05$). Steeper increase in Language Skill slope was also marginally associated with longer distractions at 24 months ($\beta = .21$, $p < .10$), and significantly associated with longer durations at 48 months ($\beta = .76$, $p < .05$), as was marginally the initial level of language ($\beta = .40$, $p < .10$). Longer distractions at 24 months were associated with a steeper increase in Anger Expression over time ($\beta = .75$, $p < .05$). However, by 48 months, distraction duration was negatively correlated with the end level of Anger Expression ($r = -.27$, $p < .05$).

Discussion

Children's growth in language development should contribute to the decline in anger expression in early childhood and enhance the strategies they can initiate to regulate frustration (Cole et al., 2010; Kopp, 1989). These findings are the first to examine prospective associations among children's language skills, the quality of child anger expression, and child-initiated regulatory strategy use. Specifically, individual differences in language skill in the toddler years (18 to 24 months), as well as a child's language growth, were associated with less quick, intense, and sustained anger by preschool age and with a decline in anger over time. In addition, the *rate* of language growth contributed to better anger regulation. Children whose language skills increased more than other children's appeared less frustrated by a delay for a reward by preschool age, and the nature of their anger expressions improved more over time. Moreover, these relations between language skill and anger expression were partially explained by children's initiation of regulatory strategies. Language skills were associated with initiation of calm support-seeking at 36 months of age and of distraction at 48 months of age, both of which were associated with less angry expressions by preschool age.

The findings support the view that language skills in toddlerhood could help children regulate their emotion as they reach preschool-age (Kopp, 1989), and lead to new questions about the specific ways that these skills may influence the decline in anger reactivity. Understanding the timing and role of language skill and specific regulatory strategies could better inform the creation of developmentally tailored interventions for emotion regulation difficulties. The present evidence is consistent with the view that the child who has a vocabulary from which to draw, and the ability to put words together to communicate, may learn to regulate anger well because they can verbalize their needs without expressing frustration nonverbally during early childhood (Cole et al., 2010; Vallotton & Ayoub, 2011). Moreover, the steeper the child's language growth across early childhood the sooner the child may be able to reflect on and understand emotional experience and to share meaning with caregivers (Cole et al., 2010; Prizant & Wetherby, 1990; Stern, 1985). Thus, it appeared that early language abilities increased the likelihood that the child would calmly seek support from mother, during an age when support seeking appears to be a bridge between complete reliance on parents for regulating negative affect and more self-reliance (Kopp, 1989).

By 48 months, children seem to rely less on their mothers for support and more on themselves, and this too may be helped by a child's language development. The fact that toddler language contributed to the duration of child-initiated distractions at 48 months, and not at earlier ages when children are more reliant on their parents for regulation (Grolnick, Bridges, & Connell, 1996), supports the view that a fund of words and the ability to put words together to generate ideas helps children distract themselves from something they want but must wait to have. Possibly, a verbally rich inner life enriches the degree to which children become absorbed in new activities when they shift attention away from the thing they desire (Cole et al., 2010). While these analyses did not reveal the qualitative aspects of *how* children used words to distract themselves, we can perhaps gain more insight using an anecdotal example taken from a 48-month-old during the Wait Task. After approximately three minutes of waiting, he began to express frustration. Then he started pushing chairs around the table, but this only briefly interrupted his frustration. He began to count the chairs next, soon counting more generally. "I counted!" he said. Then he turned attention back to the gift, "Now can I open my prize?" When told no, he resumed counting, up to 38, until he said, "I can't count anymore. I need my prize." This child was able to distract himself for a full minute, longer than the average duration of toddlers in this task, which is less than 30 seconds. The longer duration of distraction may be aided by the ability to verbally elaborate the activity of counting. Thus, it is possible that children with early verbal skills may have more opportunities to learn how to use language in this way, such that his ability to shift attention is sustained by his ability to use language while distracted.

An alternative hypothesis to language development influencing emotional development is that early individual differences in anger expression influence the development of language skills (Bloom, 1993). Trend level associations between the degree of decline in anger and subsequent language skill suggested that being high in anger reactivity may interfere with language acquisition beyond first words and vocabulary spurt (Bloom, 1993). Greater anger may interfere with interactions or relationships between caregivers and children, limiting language learning experiences (e.g., Claussen, Mundy, Mallik, & Willoughby, 2002). Poorly regulated anger may also compromise higher order cognitive and linguistic processing, recruiting resources needed for different stages of language learning (Blair, 2002; Bloom, 1993). However, in the present study associations between early anger and later language skills were not as strong as prospective relations between early language ability and a decline in anger reactivity. These findings and studies of concurrent relations between emotion regulation and language skill (Graziano, Reavis, Keane, & Calkins, 2007; Stansbury & Zimmerman, 1989) underscore the need to more closely examine reciprocal relations between language and emotional development in early childhood.

It is notable that regulatory strategies did not contribute to the associations between language skill and anger expression at all ages. The steeper children's growth in language, the more they sought support from their mothers at 36 months, which then contributed to a steeper decline in anger reactivity and less expressed anger by age 48 months. In the present study, mothers were instructed to do as they normally did when requiring their children to wait. Mothers tended to become absorbed in completing questionnaires and typically ignored children's bids about the demands of the wait. They may have thought that attending to the child would make it more difficult to complete the work or for the child to tolerate the wait. When they did interact with the child, mothers usually reminded the child to wait. For toddlers, this may render support-seeking ineffective in reducing anger. However, as children mature, support-seeking may change, supported by better established language skills and cognitive skills such as working memory (Wolfe & Bell, 2007). Indeed, children's bids for support with the challenge become calmer and less angry by age 36 months, suggesting change in how bids function (Cole et al., 2011). Parent-focused interventions could use this line of study to better inform suggested strategies for parents' of toddlers and children who struggle with challenging situations like waiting.

Similarly, toddler language skill predicted the duration of children's distractions at both 36 and 48 months. Moreover, distraction duration was associated with less anger expression only at 48 months, perhaps because at this age children's distractions were becoming more effective. This relation was found, over and above the influences of effortful control, suggesting both language and effortful control contribute to a child's ability to exert attention control during a delay task. Language skills and attention control both develop in this age period (Rueda, Acosta, & Santonja, 2007; Ruff & Rothbart, 1996) and are related to each other (Blair & Razza, 2007). Language may facilitate distraction as an emotion regulation strategy only after executive attention has matured, which may explain why infant and toddler regulatory efforts are limited in effectiveness (Buss & Goldsmith, 1998; Stifter & Braungart, 1995) and more dependent upon maternal warmth and responsiveness (Graziano, Calkins, & Keane, 2011). Future research should investigate both of these skill domains, including more direct assessment of executive function, how they influence one another over time, and how they contribute, uniquely or conjointly, to better anger regulation skills. Carefully planned intervention studies could play a key role in delineating the longitudinal influences of one domain on another.

Given the present findings, a next step is to investigate the specific aspects of language development that contribute to emotion regulation. Vocabulary size, rather than talkativeness, predicted quality of self-regulation in one study (Valloton & Ayoub, 2011). Such work must grapple with the challenge of using developmentally sensitive measures across a period of rapid language growth. A single index, e.g., MLU, may be more sensitive at early ages but less so at later ages. We used both naturalistic and standardized assessments appropriate to each child age as a robust method of assessing individual differences in language over time, which yielded stability in language level. However, this approach impeded our ability to determine which specific aspects of language (e.g., grammatical understanding, receptive versus expressive skill) contribute at which ages. Understanding the specific aspects of language that aid anger regulation would contribute to both basic and applied research. Furthermore, disentangling the associations between language, attention, inhibitory control (Carlson & Wang, 2007), and temperamental factors such as effortful control will be important for creating effective intervention in these early years and understanding how these processes work together. Our measure of effortful control is limited in that it is a parent-rated questionnaire, and future work could use multiple measures across domains to create more robust comparisons.

Because we studied a group of children who are under-represented in the literature—children whose family income was above the poverty threshold but less than middle income—the generality of the findings is not known. We focused on families with economic strain in order to capture variability that is associated with income, but in a range of income that is not correlated with the significant advantages of wealth and profound disadvantages of poverty (Hart & Risley, 1995). Studies that embrace the full diversity of conditions in which children's language and emotional development are critically needed.

We did not investigate mothers' contributions to child emotion regulation and language development in this study given our focus on self-regulation and the child's ability to initiate and maintain regulatory strategies. Hart and Risley (1995) noted that caregiver responsiveness to young children's verbal bids declined rapidly once children acquired language; the modal caregiver response to child bids by 36 months was ignoring. However, a large literature on the role of emotion discourse and parental sensitivity underscores the need to understand the role of caregivers in relations among language skills, anger regulation, and strategy use in early childhood. Further research about parental input in this process as well as additional "third variables" will further determine the extent and process of how language influences emotion regulation development. The present study establishes longitudinal relations among language development, anger expression, and regulatory strategy use that can guide future studies that examine caregiver contributions.

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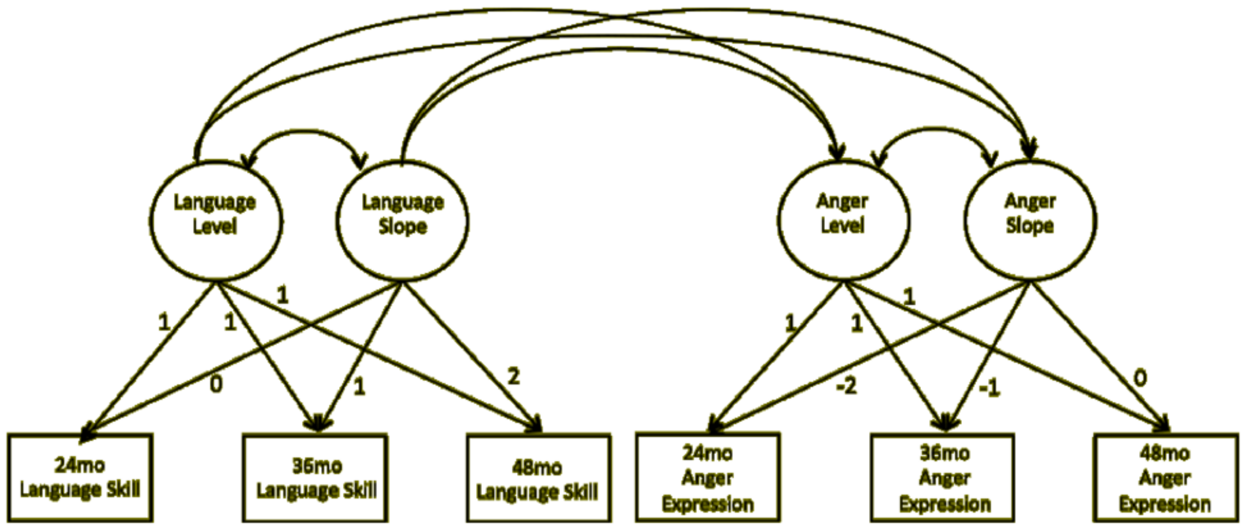

Figure 1.

Example full model of language initial level and slope predicting anger end level and slope. *Note*. Circles represent latent variables and squares represent manifest variables. Numbers on the unidirectional arrows from latent variables to manifest variables indicate loadings in the lambda matrix for the creation of linear growth models.

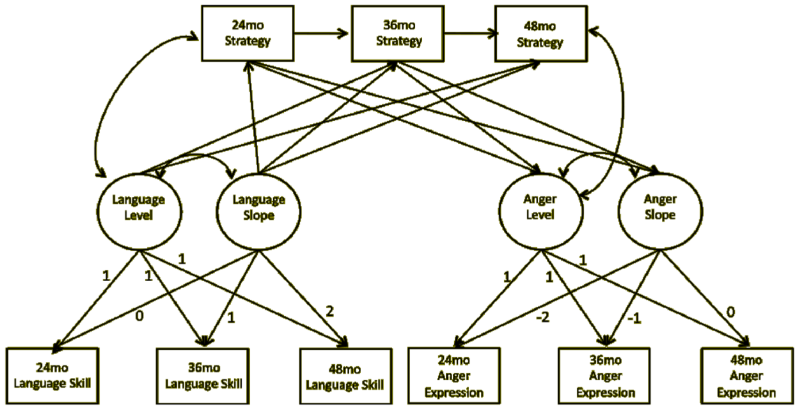

Figure 2.

Example full model of language initial level and slope predicting strategies at all three ages, which in turn predict anger end level and slope.

Note. Bidirectional arrows between latent language and anger levels and manifest strategy variables represent correlations between variables measured at the same assessment. Unidirectional arrows among latent language variables, strategy variables, and latent anger variables represent predictions. Note that there was no unidirectional or bidirectional association tested between 48mo strategy and anger slope, because a later event cannot predict or be correlated with change preceding it in time.

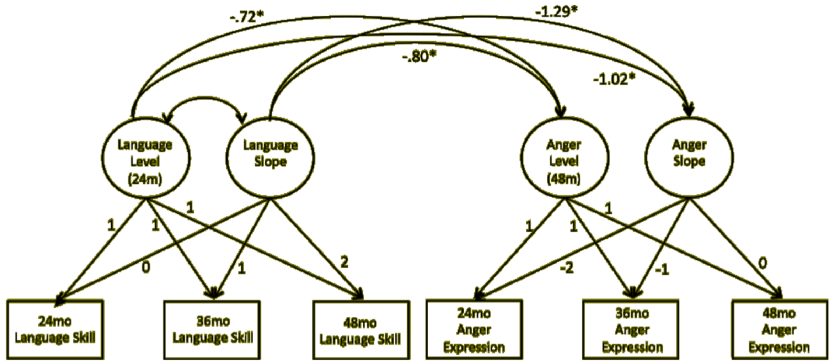

Figure 3.

Trimmed model of language skill predicting anger expression.

Note. * = $p < .05$. For clarity, covariates are not pictured.

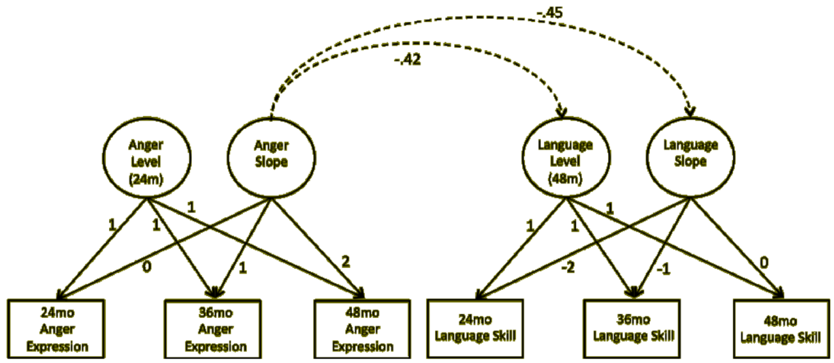

Figure 4.

Trimmed model of anger expression predicting language skill.

Note. Dashed lines indicate marginal findings where $p < .10$. For clarity, covariates are not pictured.

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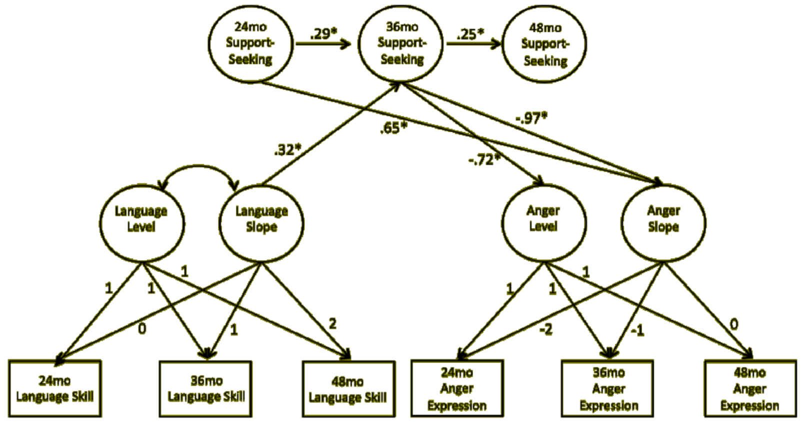

Figure 5.

Trimmed model for language skill, support-seeking, and anger expression.

Note. * = $p < .05$. Covariates and manifest variables that create the latent support-seeking factor (latency to first bout of support-seeking and average length of support-seeking) are not pictured for clarity.

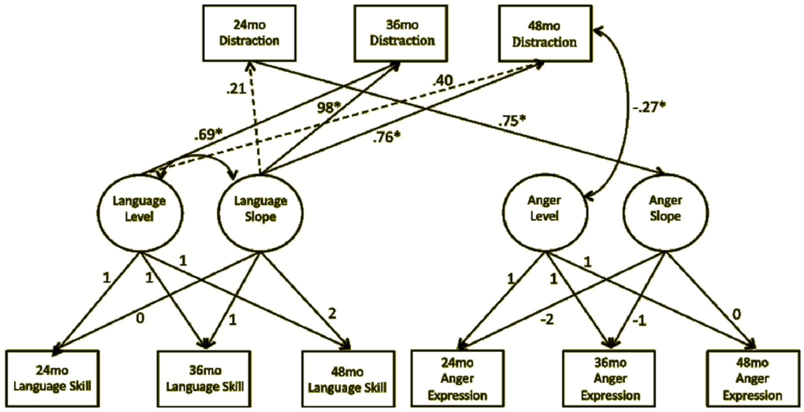

Figure 6.
Trimmed model for language skill, distraction, and anger expression.
Note. * = $p < .05$. Dashed lines indicate marginal findings where $p < .10$. For clarity, covariates are not pictured.

Table 1

Minimums, Maximums, Means, and Standard Deviations for Language Variables

	Min	Max	M	SD
Toddler Age				
18m Home Visit MLU	1.00	2.25	1.43	0.29
18m MCDI Vocabulary Comprehension	14.00	396.00	242.19	89.75
18m MCDI Vocabulary Production	0.00	323.00	75.01	71.79
24m Lab Visit MLU	1.00	2.98	1.45	0.38
Early Preschool Age				
30m Home Visit MLU	1.02	3.29	1.84	0.47
36m Lab Visit MLU	1.20	3.78	2.35	0.55
36m CELF-3 Grammatical Understanding	0.00	19.00	9.38	3.45
Preschool Age				
TOLD-P:3 Syntactic Understanding	4.00	15.00	9.64	2.43
TOLD-P:3 Sentence Imitation	5.00	16.00	9.05	3.07

Table 2

Means and Standard Deviations for Temporal Dynamics of Anger Expression and Regulatory Strategies

		Age in Months		
		24	**36**	**48**
Anger Expression				
Latency to 1st Bout	M	4.11	10.38	18.04
	SD	7.51	11.47	12.56
Average Intensity	M	2.22	1.53	0.94
	SD	0.78	0.92	0.85
Average Length	M	6.01	1.87	1.21
	SD	8.36	1.91	1.47
Support-Seeking				
Latency to 1st bout	M	15.90	5.31	3.73
	SD	12.87	8.50	8.51
Average Length	M	0.89	1.51	1.81
	SD	0.78	0.69	0.95
Focused Distractions				
Latency to 1st bout	M	10.34	7.25	3.23
	SD	10.23	8.32	4.82
Average Length	M	1.95	2.44	3.26
	SD	1.40	1.92	3.24

Table 3

Zero-Order Correlations Among Variables in the Language Composites

	1	2	3	4	5	6	7	8
1. 18m MLU	-							
2. 18m MCDI Comprehension	.06	-						
3. 18m MCDI Production	.19	.58**	-					
4. 24m MLU	.29**	.32**	.51**	-				
5. 30m MLU	.29**	.24*	.42**	.53**	-			
6. 36m MLU	.22*	.16	.26**	.40**	.53**	-		
7. 36m CELF	.12	.22*	.33**	.10	.20	.12	-	
8. 48m TOLD Grammatical Understanding	.12	.17	.25**	.25**	.13	.11	.23*	-
9. 48m TOLD Sentence Imitation	.11	.23*	.39**	.26**	.41**	.33**	.38**	.31**

Note.

* = $p < .05$;

** = $p < .01$