Development of Response Evaluation and Decision (RED) and Antisocial Behavior in Childhood and Adolescence

Reid Griffith Fontaine, University of Arizona
Chongming Yang, Duke University
Kenneth A. Dodge, Duke University
Gregory S. Pettit, Auburn University Main Campus
John E. Bates, Indiana University - Bloomington

Available at: https://works.bepress.com/reid_fontaine/17/
Development of Response Evaluation and Decision (RED) and Antisocial Behavior in Childhood and Adolescence

Reid Griffith Fontaine
University of Arizona

Gregory S. Pettit
Auburn University

Chongming Yang and Kenneth A. Dodge
Duke University

John E. Bates
Indiana University

Using longitudinal data on 585 youths (48% female; 17% African American, 2% other ethnic minority), the authors examined the development of social response evaluation and decision (RED) across childhood (Study 1; kindergarten through Grade 3) and adolescence (Study 2; Grades 8 and 11). Participants completed hypothetical-vignette-based RED assessments, and their antisocial behaviors were measured by multiple raters. Structural equation modeling and linear growth analyses indicated that children differentiate alternative responses by Grade 3, but these RED responses were not consistently related to antisocial behavior. Adolescent analyses provided support for a model of multiple evaluative domains of RED and showed strong relations between aggressive response evaluations, nonaggressive response evaluations, and antisocial behavior. Findings indicate that RED becomes more differential (or specific to response style) and is increasingly related to youths’ antisocial conduct across development.

Keywords: social information processing, decision making, antisocial behavior, child development, adolescence

Numerous social cognitive structures (e.g., beliefs about aggression; Huesmann, 1998) and online processing operations (Dodge, Coie, & Lynam, 2006) have been linked to aggressive conduct problems in youth. One domain of processing that appears to be critical is response decision making—that is, processes by which youths evaluate behavioral alternatives and decide how to respond to challenging social situations (see Fontaine & Dodge, 2006). These processes have been well studied in adult models of rational choice (Becker, 1978), but, compared with other social cognitive domains, such as knowledge structures, normative beliefs, and attributional style, response decision making has been understudied as a factor in aggressive behavior problems in children. Reasons for the relative lack of empirical inquiry may be that social developmentalists have presumed that decision-making processes are primitive in young children, difficult to reliably measure, and not strongly correlated with aggressive behavior. The purposes of the present studies were to examine developmental growth across childhood and adolescence in (a) youths’ ability to differentially evaluate alternative behavioral responses during challenging social interactions and (b) the correlation between youths’ response evaluations and their antisocial behavior.

Response Evaluation and Decision (RED)

As a component of social information processing (SIP; Crick & Dodge, 1994; Fontaine & Dodge, in press; also, see Mize & Pettit, in press, for a recent review), RED concerns the set of decision processes by which alternative responses are evaluated, assigned outcome expectancies, and compared and prioritized for ultimate response selection. Fontaine, Burks, and Dodge (2002) empirically distinguished two dimensions of RED: response valuation, which is defined by online sociomoral appraisals of aggressive response options, and outcome expectancy, which is captured by questions that relate to participants’ online estimations of outcome likelihoods with respect to aggressive response options. They demonstrated that these domains significantly and uniquely incremented the prediction of adolescents’ externalizing behavior, suggesting that RED may be a multidimensional construct. It is important to note that whereas response evaluation refers to the global appraisal of behavioral options across multiple domains, response valuation is the process by which the sociomoral qualities of a behavior are specifically considered.
Fontaine and Dodge (2006) proposed a model of RED by which several decision-making processes were proposed: (a) response valuation, or the appraisal of the social and moral qualities of a response (see Astor, 1994); (b) response efficacy, or the estimation of how easy or hard it is to behaviorally enact a response (see Bandura, 1982; Cuddy & Frame, 1991); and (c) outcome consistency, or the anticipation or likelihood that a particular outcome will result from the behavior (see Cuddy & Frame, 1991; Feather, 1982). There are numerous different types of outcome expectancy, including positive (or desired) versus negative (or aversive), intrapersonal (e.g., emotional) versus extrapersonal (e.g., societal), and instrumental (or goal driven) versus social (or interpersonal). RED hypothesizes that a multitude of different outcome expectancies are potentially at play during an individual’s response decision making.

Empirical evidence has supported the hypothesis that each domain is significantly correlated, at the bivariate level, with aggressive behavior during adolescence (see Fontaine, 2006b; Fontaine & Dodge, 2006). However, little is known about the early development of RED and how it relates to antisocial behavior across childhood and adolescence. In addition, it is unknown as to when children develop the ability to activate RED, even at a basic or general level, in their behavioral evaluation and social decision making.

Development of Executive Function

The period from early school years through late adolescence is marked by remarkable growth in social and nonsocial cognition (see Flavell, Miller, & Miller, 1993). Because RED processes require mental representation of the anticipated consequences and value of possible behaviors, it was hypothesized that internal consistency and response-specific differentiation of these processes would not be present in early childhood but would develop during middle childhood years. This hypothesis is supported by considerable theory and science in developmental psychology, stemming primarily from scientific research on the development of executive function (e.g., Séguin & Zelazo, 2005; Zelazo & Müller, 2002). The role of RED in youth social cognitive processing was hypothesized to develop in multiple ways, including internal consistency of responding, specificity (i.e., differentiation among domains), and concurrent relation to antisocial behavior.

It is well established that children develop skills in executive function—typically defined as one’s “self-regulation of thought, action, and emotion” (Séguin & Zelazo, 2005, p. 307)—including cognitive activities such as decision making and perspective taking, across childhood (see Zelazo & Müller, 2002). Children begin to demonstrate executive abilities as early as 1 year of age, and most abilities have become active by 8 years of age (Ardila & Rosselli, 1994; Case, 1992; De Luca et al., 2003; Luciana & Nelson, 1998). There remains some uncertainty as to individual differences in the onset and development of specific executive skills, and social evaluation and response decision-making functions are no exception. Further impetus for examining early RED processing and antisocial behavior is the current trend to associate delays or other problems in executive function development with a variety of social problems and clinical syndromes, including disruptive behavior disorders, in early childhood (De Luca et al., 2003; Tremblay et al., 2005; Zelazo & Müller, 2002).

Early adolescence is marked by increases in a number of advanced cognitive abilities, including self-regulatory cognitive processes, abstract reasoning, deductive reasoning, and information processing (Cobb, 1992; Keating, 1980, 2004; Steinberg, 2005). Social judgment and decision making develop considerably as children enter adolescence as well. Early adolescence brings increased ability to consider risks and alternative consequences in social situations, take the perspectives of others, and consider hypothetical scenarios (Keating, 1980, 2004; Steinberg, 2005). In the last decade, scientific attention to behavioral decision making in adolescence has increased, particularly with respect to antisocial behavior and criminal culpability (e.g., Cauffman & Steinberg, 2000; Fried & Reppucci, 2001; Miller & Byrnes, 1997; Steinberg & Cauffman, 1996). The present studies were conducted to test the hypotheses that RED processing would increase in internal consistency across childhood, increase in differentiation of complexity during adolescence, and increase in relation to antisocial behavior during adolescence.

Study 1: Childhood

Dodge and Price (1994) hypothesized, and found evidence suggesting, that (a) SIP skills and (b) relations between SIP patterns and behavior increase with age as youths develop. Guided by basic social developmental research, the reasoning underlying these hypotheses was that although some elementary cognitive processes may be innate, via ongoing individual–environment transactions, children’s social cognitive abilities and interpersonal strategies become more complex as a function of normal development. Consistent with this rationale, we hypothesized in Study 1 that young children’s RED processing is basic and relatively unsophisticated. Basic RED processing was operationalized as the ability to assess the overall “goodness” or “badness” of alternative social behaviors and was assessed across kindergarten through Grade 3.

Hypotheses

Two hypotheses guided this investigation. First, we examined the relation between children’s evaluations (or endorsements) of aggressive response options (called “aggressive RED”) and nonaggressive response options (called “nonaggressive RED”). Namely, we were interested in whether children evaluate their own possible behavioral responses to provocation reliably and differentially across early school years. Psychometric reliability was operationalized as internal consistency across items. Differential responding was operationalized as significant differentiation between aggressive RED and nonaggressive RED. It was hypothesized that children’s RED would become more reliable across time and that differentiation between children’s aggressive and nonaggressive RED would increase across development. Second, we investigated the degree to which children’s aggressive and nonaggressive RED were associated with their antisocial behavior across development. We hypothesized that aggressive RED becomes more positively related, and nonaggressive RED becomes more negatively related, to antisocial behavior as children get older.

Method

Participants. Two cohorts of children entering kindergarten and their families were recruited to participate in a longitudinal
investigation of the development of conduct problems in April of 1987 and 1988 (Child Development Project; see Dodge, Bates, & Pettit, 1990; Dodge et al., 2003; Pettit, Bates, & Dodge, 1997). Participants were drawn from three geographic regions: Bloomington, IN and Knoxville and Nashville, TN. Bloomington is a town of approximately 60,000 residents, many with Appalachian ancestry. Its neighborhoods range from mobile home parks to planned developments. Knoxville is an Appalachian metropolitan area of approximately 200,000 residents with neighborhoods that range from rural to suburban. Nashville is a mid-South metropolitan area of over one million people with a broad economic base and neighborhoods that range from federally subsidized housing projects to affluent suburbs.

Children were randomly selected at preregistration for kindergarten and asked to participate in the study. Approximately 15% of the children at targeted schools did not preregister, thus this proportion of the sample was recruited by mail or telephone. Approximately 75% of those recruited agreed to participate. The total sample in the first year (kindergarten) of the Child Development Project consisted of 585 children (48% female; 81% Caucasian, 17% African American, 2% minority from other ethnic backgrounds), each from a different family. All participants spoke English; the percentage of families for which English was not the primary language is unknown, though it is estimated to be small. The Hollingshead (1979) index of families’ socioeconomic status showed a range from 11 to 66, with a mean in the low middle-class range (M = 39.59, SD = 13.96). Assessments for the current study were conducted at kindergarten and Grades 1 (n = 537; 92% of the original sample), 2 (n = 517; 88%), and 3 (n = 498; 85%).

**RESPONSE EVALUATION AND DECISION (RED) procedure and protocol.** RED assessment was administered as part of a larger SIP protocol (see Dodge, Pettit, Bates, & Valente, 1995; Weiss, Dodge, Bates, & Pettit, 1992) during each of the first 4 years (kindergarten through Grade 3) of the Child Development Project. Participants viewed a series of 24 randomly ordered video vignettes of benign, ambiguous, and hostile provocation situations that are relevant to child life during early school years. Each vignette involved four video segments. The first segment presented the social stimulus, half of which were provocations (e.g., being hit in the back with a ball) and half of which were rebuff from peer group entry (e.g., being excluded from joining a sports team). The final three segments presented alternative responses (aggressive, nonaggressive–competent, and nonaggressive–inert responses), in randomly varied order, to the stimulus. Actors were given scripts written to depict responses, for which multiple “takes” were video recorded. Pilot youth and adult viewers selected the versions that most clearly and realistically depicted the intended behaviors. Only the aggressive and nonaggressive–competent response alternatives were examined in this study. Participants were asked to imagine themselves as the protagonist in the situation (i.e., the individual who has suffered a negative outcome because of the peer’s behavior) prior to viewing each segment of all 24 video vignettes. Following each video response, participants were asked to evaluate the response (“Do you think that’s a good thing or a bad thing to say or do?”) on a pictorial scale that ranged from 1 (very bad) to 4 (very good). An aggressive response valuation variable was computed by taking the average score for this question that corresponded to the video-recorded aggressive response across all 24 vignettes; likewise, a nonaggressive–competent response valuation variable was computed by taking the average score for this question with respect to the nonaggressive–competent response across the 24 vignettes.

**Antisocial behavior.** The Child Behavior Checklist (CBCL; mother report) and Teacher Report Form (Achenbach, 1991a, 1991b, 1991c) measures of Externalizing problems (comprised of Aggressive and Delinquent conduct problem subscales) were administered and collected in kindergarten through Grade 3. Aggressive (bullies, fights, threatens, etc.) and Delinquent (lies, steals, vandalizes, etc.) subscale items were rated according to frequency on a 0 to 2 metric. The reliability and validity of these measures have been established to be excellent in numerous empirical investigations. Reliability has been repeatedly demonstrated to be high, based on strong 1-week test–retest coefficients. In addition, comparative reviews of alternative instruments that measure youth conduct problems have noted that Achenbach’s (1991a, 1991b, 1991c) measures of Externalizing problems are among the strongest with respect to convergent, discriminant, and predictive validity and have recommended the CBCL, in particular, as the preferred instrument to assess youth behavioral competencies and problems (Wells, 1995). We herein use the terms antisocial behavior and externalizing problems synonymously.

**Analysis plan.** It is important to note that this section provides both the general analysis plan that was followed for Studies 1 and 2 (and is referenced below in the specific analysis plan for Study 2) as well as the specific analysis plan for Study 1. Structural equation modeling (Mplus 4.1, Muthén & Muthén, 1998–2006) was used to test all hypotheses. Missing values were handled with the full information maximum likelihood estimation in Mplus, where missingness was treated as a function of available observed covariates and outcome variables. As preliminary analyses, confirmatory factor analyses of the aggressive response valuation and nonaggressive response valuation constructs were conducted separately for each wave of data to ensure unidimensionality. Measurement invariance of RED scales from kindergarten through Grade 3 and from Grade 8 through Grade 11 was examined via confirmatory factor analysis by comparing a model without equality constraints on the factor loadings and other models with such constraints in terms of chi-square difference and degree of freedom difference. Because of the large number of indicators (24) in the RED measure, the model for the first wave (kindergarten) was paired with each of the three additional waves (Grades 1–3) to test invariance of factor loadings. Models without equality constraints on the factor loadings across waves served as baseline models in each case. In addition, composite scores of each scale item were used as a single indicator of a latent construct. Factor loading λ was obtained by taking the square root of reliability ω (λ = √ω), and error variance of each scale was partitioned out (1 − ω) in subsequent structural equation modeling of RED. In a measurement model with a single indicator, the variance of the latent construct is equivalent to the squared factor loading ω = λ^2, a notion that is analogous to the squared regression coefficient (β) in a regression model with a single independent variable. The reliability coefficient (ωj) for a particular scale j was calculated using the formula, ωj = (Σλj)^2/(Σλj)^2 + Σσ^2, where (Σλj)^2 stands for the square of the sum of factor loadings and Σσ^2 represents the sum of unique variances (McDonald, 1999, p. 88), which was more appropriate for ordinal scales.
With desirable measurement properties, a measurement model with both aggressive and nonaggressive evaluation and antisocial constructs was specified for Studies 1 and 2, exclusively to test the concurrent correlations between aggressive and nonaggressive RED constructs. The invariance of the correlations over time was tested by comparing this model with others that had equality constraints on the correlations in terms of chi-square difference and degree of freedom difference. Next, a cross-lagged model with growth trajectory intercepts and slopes was specified to examine (a) stability of RED constructs through their autoregressive paths and (b) relations of RED to antisocial constructs across time while controlling for one another. Equivalence of corresponding paths over time was also tested by comparing models with and without equality constraints in terms of chi-square and degree of freedom differences. As is demonstrated in Study 2 below, a similar model was used to examine the developmental trends of the aggressive RED and nonaggressive RED difference scores (aggressive RED – nonaggressive RED) and their developmental relation with antisocial constructs across adolescence in the same fashion. The results reported were based on the final model with equality constraints that was proved by model comparisons.

**Results**

**Measurement properties of RED constructs.** Standardized factor loadings of aggressive and nonaggressive RED are listed in Table 1. The reliability coefficient \( \omega \) is listed under the factor loadings, all of which were above .93, denoting that internal consistency was uniformly high. A series of invariant measurement tests indicated that most items had similar factor loadings from kindergarten to Grade 2. The majority of loadings in Grade 3 were found to be different but improved in measurement quality from their corresponding reference items in Grade 1.

**Relations among RED constructs.** The measurement model fit the data well, \( \chi^2(181) = 519.15, p < .01 \), comparative fit index (CFI) = .95, Tucker–Lewis index (TLI) = .92, root-mean-square error of approximation (RMSEA) = .06, and revealed the following findings. The aggressive RED construct was positively correlated with the nonaggressive RED construct at \( \phi_1 = .48 \) (confidence interval [CI] = .40 to .55, \( p < .01 \)) in kindergarten and at \( \phi_2 = .29 \) (CI = .20 to .39, \( p < .01 \)) in Grade 1. In Grade 2, these two constructs were not significantly correlated at \( \phi_3 = .05 \) (CI = -.06 to .16, \( p > .05 \)). In Grade 3, the two constructs were not significantly correlated.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Kindergarten</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item–vignette no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.47</td>
<td>.44</td>
<td>.59</td>
<td>.57</td>
</tr>
<tr>
<td>2</td>
<td>.61</td>
<td>.51</td>
<td>.67</td>
<td>.55</td>
</tr>
<tr>
<td>3</td>
<td>.55</td>
<td>.40</td>
<td>.69</td>
<td>.59</td>
</tr>
<tr>
<td>4</td>
<td>.64</td>
<td>.54</td>
<td>.66</td>
<td>.59</td>
</tr>
<tr>
<td>5</td>
<td>.69</td>
<td>.57</td>
<td>.77</td>
<td>.66</td>
</tr>
<tr>
<td>6</td>
<td>.66</td>
<td>.48</td>
<td>.74</td>
<td>.58</td>
</tr>
<tr>
<td>7</td>
<td>.73</td>
<td>.51</td>
<td>.75</td>
<td>.62</td>
</tr>
<tr>
<td>8</td>
<td>.63</td>
<td>.63</td>
<td>.69</td>
<td>.63</td>
</tr>
<tr>
<td>9</td>
<td>.72</td>
<td>.60</td>
<td>.70</td>
<td>.57</td>
</tr>
<tr>
<td>10</td>
<td>.74</td>
<td>.70</td>
<td>.71</td>
<td>.65</td>
</tr>
<tr>
<td>11</td>
<td>.71</td>
<td>.66</td>
<td>.75</td>
<td>.69</td>
</tr>
<tr>
<td>12</td>
<td>.67</td>
<td>.64</td>
<td>.74</td>
<td>.67</td>
</tr>
<tr>
<td>13</td>
<td>.64</td>
<td>.65</td>
<td>.76</td>
<td>.58</td>
</tr>
<tr>
<td>14</td>
<td>.72</td>
<td>.62</td>
<td>.72</td>
<td>.52</td>
</tr>
<tr>
<td>15</td>
<td>.69</td>
<td>.58</td>
<td>.78</td>
<td>.65</td>
</tr>
<tr>
<td>16</td>
<td>.75</td>
<td>.64</td>
<td>.73</td>
<td>.67</td>
</tr>
<tr>
<td>17</td>
<td>.71</td>
<td>.65</td>
<td>.80</td>
<td>.62</td>
</tr>
<tr>
<td>18</td>
<td>.66</td>
<td>.65</td>
<td>.80</td>
<td>.70</td>
</tr>
<tr>
<td>19</td>
<td>.63</td>
<td>.58</td>
<td>.76</td>
<td>.68</td>
</tr>
<tr>
<td>20</td>
<td>.72</td>
<td>.69</td>
<td>.75</td>
<td>.64</td>
</tr>
<tr>
<td>21</td>
<td>.65</td>
<td>.63</td>
<td>.77</td>
<td>.71</td>
</tr>
<tr>
<td>22</td>
<td>.68</td>
<td>.67</td>
<td>.73</td>
<td>.71</td>
</tr>
<tr>
<td>23</td>
<td>.67</td>
<td>.56</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>24</td>
<td>.62</td>
<td>.58</td>
<td>.75</td>
<td>.74</td>
</tr>
<tr>
<td>Reliability ( \omega )</td>
<td>.95</td>
<td>.93</td>
<td>.97</td>
<td>.94</td>
</tr>
</tbody>
</table>

Model fit: \( \chi^2(197) = 671.87, p < .01, \) CFI = .95, \( \chi^2(135) = 487.81, p < .01, \) CFI = .97, \( \chi^2(124) = 335.13, p < .01, \) CFI = .98, \( \chi^2(102) = 581.95, p < .01, \) CFI = .96, TLI = .95, RMSEA = .06, TLI = .96, RMSEA = .06, TLI = .94, RMSEA = .06, TLI = .92, RMSEA = .09.

**Note.** Aggr = aggressive response evaluation and decision; Nonaggr = nonaggressive response evaluation and decision; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root-mean-square error of approximation.
negatively correlated at \( \phi_k = -.53 \) (CI = -.61 to -.45, \( p < .01 \)). Chi-square difference tests based on model comparison confirmed that the correlations changed not only in magnitude over time, but also in sign, with \( \phi 1 \neq \phi 2, \chi^2_{ad}(1) = 12.75, p < .01; \phi 2 \neq \phi 3, \chi^2_{ad}(1) = 21.41, p < .01; \) and \( \phi 3 \neq \phi 4, \chi^2_{ad}(1) = 64.99, p < .01 \). These findings indicate that children shifted from a general response bias to a pattern of differentiation between aggressive and nonaggressive RED alternatives across the developmental period from kindergarten to Grade 3. The zero-order intercorrelations of the constructs, listed in Table 2, show that nonaggressive RED was correlated with antisocial constructs at certain grades. However, these correlations and predictive relations are better depicted in the cross-lagged model shown in Figure 1.

Predictive relations between RED and antisocial behavior.

The cross-lagged model (see Figure 1) fit the data well, \( \chi^2(223) = 605.60, p < .01 \), CFI = .94, TLI = .93, RMSEA = .05, and revealed the following findings concerning the stability and predictive relations. First, both aggressive and nonaggressive RED were relatively stable from kindergarten through Grade 2, as indicated by the moderate and statistically equivalent autoregressive coefficients for aggressive RED from kindergarten to Grade 1 \( (\beta = .47, CI = .39 to .54, p < .01) \) and from Grade 1 to Grade 2 \( (\beta = .57, CI = .50 to .65, p < .01) \) and for nonaggressive RED from kindergarten to Grade 1 \( (\beta = .52, CI = .44 to .60, p < .01) \) and from Grade 1 to Grade 2 \( (\beta = .51, CI = .43 to .59, p < .01) \). Second, aggressive RED underwent notable changes from Grade 2 to Grade 3, as indicated by the low autoregressive coefficient for aggressive RED \( (\beta = .32, CI = .23 to .40, p < .01) \). Chi-square difference tests showed that the autoregressive coefficients were significantly different from previous ones for aggressive RED, \( \chi^2_{ad}(1) = 5.38, p < .05 \).

The cross-lagged model also revealed that nonaggressive RED had a weak but significant relation to the antisocial construct over time, as indicated by the negative correlation between nonaggressive RED and antisocial behavior in kindergarten \( (\phi = -.10, CI = -.20 to -.01, p < .05) \) and the path coefficient from nonaggressive RED at kindergarten to antisocial behavior at Grade 1 \( (\beta = -.05, CI = -.10 to -.00, p < .05) \), from nonaggressive RED at Grade 1 to antisocial behavior at Grade 2 \( (\beta = -.04, CI = -.08 \) to \( -.00, p < .05 \), and from nonaggressive RED at Grade 2 to antisocial behavior at Grade 3 \( (\beta = -.05, CI = -.08 to -.00, p < .05) \). In contrast, aggressive RED was not significantly related to antisocial behavior from kindergarten to Grade 3.

The last finding from the cross-lagged model was that antisocial behavior became more stable over time, as shown by the increasing autoregressive path coefficient of the antisocial construct from kindergarten to Grade 1 \( (\beta = .79, CI = .73 to .85, p < .01) \), from Grade 1 to Grade 2 \( (\beta = .90, CI = .85 to .96, p < .01) \), and from Grade 2 to Grade 3 \( (\beta = .93, CI = .88 to .98, p < .01) \). A chi-square difference test showed that the three coefficients were significantly different from one another, \( \chi^2_{ad}(2) = 9.28, p < .01 \). This model explained 23%, 33%, and 10% variance of the aggressive RED construct at Grades 1, 2, and 3, respectively; 28%, 26%, and 12% variance of the nonaggressive RED construct at Grades 1, 2, and 3, respectively; and 63%, 82%, and 87% variance of the antisocial construct at Grades 1, 2, and 3, respectively.

Gender and ethnic differences in the cross-lagged model.

Gender differences were found in the predictive paths from aggressive and nonaggressive RED at Grade 2 to antisocial behavior at Grade 3, \( \chi^2_{ad}(2) = 10.13, p = .01 \), which suggested stronger relations in males. Interpretation was omitted here because of a suppressor effect. Ethnic differences in stability of both aggressive and nonaggressive RED constructs from Grade 2 to Grade 3 were detected, \( \chi^2_{ad}(2) = 8.99, p < .05 \). The stability in aggressive RED \( (\beta = .58, CI = .40 to .75, p < .01) \) and nonaggressive RED \( (\beta = .59, CI = .40 to .78, p < .01) \) in the ethnic minority group were much stronger than stability in aggressive RED \( (\beta = .25, CI = .15 to .35, p < .01) \) and nonaggressive RED \( (\beta = .20, CI = .09 to .32, p < .01) \) in the Caucasian group.

Discussion

Development of RED processes. Beginning with kindergarten, children’s RED processes were found to be highly internally consistent. High reliability of responding to both aggressive and nonaggressive stimuli suggests that, at kindergarten at the latest, children evaluate aggressive and nonaggressive responses to provocations consistently. However, the relation between responses to

Table 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Antisoc K</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Antisoc G1</td>
<td>.81**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Antisoc G2</td>
<td>.76**</td>
<td>.99**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Antisoc G3</td>
<td>.65**</td>
<td>.86**</td>
<td>.99**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. ARED K</td>
<td>.06</td>
<td>-.02</td>
<td>-.03</td>
<td>-.01</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ARED G1</td>
<td>.09</td>
<td>.08</td>
<td>.07</td>
<td>-.04</td>
<td>.44**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. ARED G2</td>
<td>.09</td>
<td>.06</td>
<td>.06</td>
<td>.03</td>
<td>.36**</td>
<td>.56**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. ARED G3</td>
<td>-.02</td>
<td>-.01</td>
<td>-.04</td>
<td>-.04</td>
<td>.17**</td>
<td>.29**</td>
<td>.33**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. NRED K</td>
<td>-.10*</td>
<td>-.15*</td>
<td>-.26**</td>
<td>-.22**</td>
<td>.48**</td>
<td>.25**</td>
<td>.12</td>
<td>.12</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. NRED G1</td>
<td>-.09</td>
<td>-.15*</td>
<td>-.18**</td>
<td>-.07</td>
<td>.10</td>
<td>.13*</td>
<td>.05</td>
<td>-.02</td>
<td>.35**</td>
<td>.55**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>11. NRED G2</td>
<td>-.04</td>
<td>.02</td>
<td>-.03</td>
<td>.07</td>
<td>.13*</td>
<td>.05</td>
<td>-.02</td>
<td>.35**</td>
<td>.55**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. NRED G3</td>
<td>.08</td>
<td>.04</td>
<td>.01</td>
<td>.03</td>
<td>-.06</td>
<td>-.05</td>
<td>-.06</td>
<td>-.53**</td>
<td>.02</td>
<td>.10</td>
<td>.32**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note. Antisoc = antisocial; K = kindergarten; G1 = Grade 1; G2 = Grade 2; G3 = Grade 3; ARED = aggressive response evaluation and decision; NRED = nonaggressive response evaluation and decision; \( * p < .05 \); \( ** p < .01 \).
aggressive stimuli and responses to nonaggressive stimuli changed drastically from kindergarten to Grade 3. In kindergarten, we found evidence in favor of a generic response style, in that responding to both kinds of stimuli was significantly positively correlated. Children were prone to evaluate responses, regardless of whether the response was aggressive or nonaggressive, in a similar manner. In other words, children tended to evaluate both aggressive and nonaggressive responses with some degree of favor, neutrality, or disfavor. This pattern decreased significantly from kindergarten to Grade 1, although a response style effect remained in Grade 1 as well. By Grade 2, the response style effect had disappeared, and we found that there was no relation between responding to aggressive and nonaggressive stimuli. Further differentiation was observed in children’s transition from Grade 2 to Grade 3, as we found that valuations of aggressive and nonaggressive responses became correlated in the negative direction. By Grade 3, individual differences had developed in children’s propensity to evaluate aggressive responses more favorably than nonaggressive responses. This trend suggests that early school years are critical to the child’s developing ability to discern socially meaningful differences between alternative responses to varied provocation situations. Children appear to have little ability to distinguish the acceptability of aggressive versus nonaggressive responses to provocations in kindergarten and Grade 1. Instead, their responses reflect an internal propensity to evaluate any response as good or bad. By Grade 3, they judge these response alternatives to be quite different and even in direct opposition to each other. Furthermore, age trends indicated that children gradually rated aggressive responses more negatively and nonaggressive responses more favorably. RED processing requires the child to hold a hypothetical behavior in mind while evaluating its associated consequences, a task that requires more advanced Piagetian skills (Piaget, 1929, 1965). Consistent with Piaget’s seminal works, results from the first 4 years of this study suggest that this level of processing does not become coherent until later in development (i.e., no earlier than middle childhood).

Development of the relation between RED and antisocial behavior. The relation between RED and antisocial behavior during early school years was limited. RED in response to aggressive stimuli was not significantly related to antisocial behavior at any grade (kindergarten through Grade 3). Modest negative correlations between RED in response to nonaggressive stimuli and antisocial behavior were observed at kindergarten and Grade 1 but not at Grades 2 and 3. In addition, RED difference scores were correlated with antisocial behavior at kindergarten and Grade 1 but not at Grades 2 and 3. Although RED in response to nonaggressive stimuli was related to antisocial conduct during kindergarten and Grade 1 in the expected direction, it is unclear why this pattern did not persist through Grades 2 and 3. It may be that more aggressively behaving children had learned that nonaggressive responses are more socially favorable by Grade 2 and thus did not evaluate these responses in significantly different ways from nonaggressive children. Overall, results of this study did not suggest that RED plays a substantial role in the development of antisocial conduct problems during early school years.

Study 2: Adolescence

Dodge and Price (1994) hypothesized that SIP patterns (e.g., encoding skills, attributions, response generation) are more sophisticated among older than younger children as a reflection of growth in executive function skills. Results supported this developmental hypothesis, and the authors concluded that “as skill in a processing task increases across age, it becomes more relevant to individual differences in behavior” (Dodge & Price, 1994, p. 1395). However, Dodge and Price did not examine multiple dimensions of response decision making or the association between response decision-making dimensions and antisocial behavior.

Subsequent research by Fontaine et al. (2002) empirically distinguished theoretically distinct domains of RED, providing strong evidence that, by adolescence, RED processing is more complex than is represented by a basic appraisal of a response’s overall goodness or badness. Drawing from numerous independent programs of social cognitive and social developmental research, Fontaine and Dodge (2006) provided a detailed account of qualitatively differentiable evaluative domains by which attributes of alternative behaviors and their associated outcomes may be assessed. Among the hypothesized domains that were stressed as most important were alternative types of outcome expectancy and behavioral efficacy—however, most investigations have been limited in that they have only conceptualized and measured these constructs as latent cognitive structures (e.g., Crick & Ladd, 1990; Cuddy & Frame, 1991; Perry, Perry, & Rasmussen, 1986; also, see Bandura, 1977, 1982). The current study reports the first known effort to assess aspects of the multidimensionality of RED patterns, that is, the internal consistency of responding within dimensions,
the differentiation across dimensions, and the relation between these patterns and aggressive behavior across adolescence. On the basis of Fontaine and Dodge’s (2006) framework, it was hypothesized that, by adolescence, advanced differentiable social cognitive operations—namely, response efficacy, emotional outcome expectancy, and social outcome expectancy—that define RED processing become relevant to conduct problem behaviors.

This study was composed of social cognitive and behavioral assessments of adolescent participants at Grades 8 and 11. Consistent with our hypotheses in Study 1, we investigated the internal consistency of aggressive and nonaggressive RED and change in their relation across time. We hypothesized that RED processing is sufficiently developed by adolescence that qualitatively distinct domains of responding to aggressive and nonaggressive stimuli are empirically differentiable. We tested the hypothesis that there are distinct domains of RED that contribute to adolescents’ social functioning, both within and across grades. Second, we tested correlations between evaluative responses to aggressive and nonaggressive stimuli and antisocial behavior. We hypothesized a positive relation between aggressive RED and antisocial behavior. We hypothesized a distinct domains of RED that contribute to aggressive and nonaggressive stimuli and antisocial behavior. We hypothesized a positive relation between aggressive RED and antisocial behavior and a negative relation between nonaggressive RED and antisocial behavior that becomes stronger across adolescence.

**Method**

**Participants.** Study 2 assessments were conducted when participants in the Child Development Project were in Grades 8 (n = 394; 67% of the original sample) and 11 (n = 418; 71%).

**RED procedure and protocol.** An adolescent version of the SIP video assessment was designed and administered in Grades 8 and 11, and the RED protocol was expanded to include questions that were hypothesized to represent qualitatively distinct domains of response decision making. Participants watched each of six video vignettes of hypothetical ambiguous provocation situations that are relevant to everyday adolescent life. Participants were instructed to imagine themselves as the protagonist (the responding individual who has suffered a negative outcome as a result of another’s actions) in each social situation. Each vignette was presented in three segments. The first segment presented an ambiguous provocation situation in which the protagonist suffered a negative outcome. For example, in one of the vignettes, participants imagined themselves as the protagonist approaching an apparently abandoned backpack in a school hallway. Upon picking up the backpack to inspect it, the ambiguous provocateur walks up to the protagonist and states, with neutral affect and intonation, “That’s my backpack.” In the second segment of each vignette, participants were asked to imagine themselves as the protagonist responding aggressively toward the ambiguous provocateur. In the backpack example, participants were asked to imagine themselves responding by saying, in an overtly hostile manner, “Look, I didn’t know whose it was. I was just looking at it, okay?!?!” In the third segment of each vignette, participants were asked to imagine themselves as the protagonist responding nonaggressively—competently toward the ambiguous provocateur. In the backpack example, participants were asked to imagine themselves responding by saying “Oh, okay. I was just about to take it to ‘Lost and Found’.”

Following each segment, participants answered questions that represent theoretically distinguished domains of RED. Questions were displayed on the video monitor as they were read aloud by the narrator. In addition, a paper copy of the questions was presented, and participants circled answers from a list of scaled choices that corresponded to each question. Three questions, each representing a theoretically distinct domain of RED, followed each of the six aggressive stimuli: (a) How easy would it be for you to act like this? (response efficacy; answered according to a 5-point continuous scale from very easy to very hard), (b) If you acted this way, how would you feel about yourself? (emotional outcome expectancy; 5-point scale from very good to very bad), and (c) How much would other people like you if they saw you acting like this? (social outcome expectancy; 5-point scale from very much to not at all). Six scores (response efficacy, emotional outcome expectancy, and social outcome expectancy for each of the aggressive and nonaggressive stimuli) were computed by taking the average score across the six vignettes for each question.

**Antisocial behavior.** The CBCL (mother report) and Youth Self-Report (Achenbach, 1991a, 1991b, 1991d) measures of Externalizing problems were administered at Grades 8 and 11. A more detailed description of the Achenbach measures of Externalizing problems is provided in Study 1.

**Analysis plan.** The specific plan for this study is as follows. First, a measurement model of the two aggressive and nonaggressive RED constructs and an antisocial construct was estimated for both Grades 8 and 11, which served as a baseline model. Composite scores of the original items of each construct were used as indicators. Measurement invariance over time was tested by comparing the baseline model with another model that had equality constraints on factor loadings over time in terms of chi-square differences. The equivalence of correlation between aggressive and nonaggressive RED across time was also tested by comparing the baseline model with another model that had the correlations constrained to be equal. Second, a cross-legged model with invariant measurement was specified to estimate the predictive relations among aggressive and nonaggressive RED constructs and antisocial constructs across time.

**Results**

**Measurement properties of and interrelations among RED constructs.** The measurement model of RED constructs with equality constraints on the factor loadings across time fit the data well, 

---

1 A fourth RED question was asked that was designed to assess participants’ instrumental outcome expectancy. Unlike the other RED questions, which were framed identically across vignettes, the instrumental outcome expectancy question was framed specific to the content of the vignette. For example, in the backpack vignette, participants were asked, “Would acting this way cause the other girl to be mean later if she saw you with something of hers again?” In this way, the instrumental goal was presumed for participants in each vignette. The internal consistency of this question across the six vignettes was low in both Grades 8 (α = .30) and 11 (α = .07); as a result, it was not included in subsequent analyses. Asking a uniform and nonspecific instrumental outcome expectancy question, such as, “How likely is it that acting this way would help you to get what you want?,” would have allowed participants to answer the question with their own instrumental goals in mind and may have resulted in higher internal consistency. Also, in Grade 11, two additional RED questions were asked that were not included in this study to maintain consistency in measurement of the RED latent construct across Grades 8 and 11.
The factor loadings are listed in Table 3. Measurement invariance over time was found for the RED constructs, \( \chi^2(142) = 407.90, p < .01, \text{CFI} = .95, \text{TLI} = .93, \text{RMSEA} = .06. \) The model revealed the following findings. First, antisocial behavior was stable from Grade 8 to Grade 11, as indicated by the path coefficient \( \gamma = .94 (CI = .85 \text{ to } 1.02, p < .01). \) Second, antisocial behavior at Grade 8 was predictive of aggressive RED (\( \beta = .20, CI = .07 \text{ to } .32, p < .01 \)) and nonaggressive RED (\( \beta = -.33, CI = -.45 \text{ to } -.22, p < .01 \)) at Grade 11. Third, when controlling for antisocial behavior at Grade 8, aggressive and nonaggressive RED were no longer predictive of antisocial behavior at Grade 11. This model explained 88% variance of the antisocial construct, 21% variance of the aggressive RED construct, and 10% variance of the nonaggressive RED construct.

Gender and ethnic differences. Gender and ethnic differences in levels and intercorrelations of the development of RED were tested. We focused tests on concurrent relations between RED and antisocial behavior and found no significant gender, \( \chi^2(7) = 13.43, p = .06, \) or ethnicity, \( \chi^2(7) = 9.02, p = .25, \) differences in adolescence.

Discussion

Development of RED processes. The negative relation between aggressive and nonaggressive RED that was first observed between participants’ general RED processing of these alternative responses in Grade 3 (in Study 1) was observed across specific domains of RED in adolescence as well. All aggressive RED domains were negatively correlated with their corresponding nonaggressive RED domains at both Grades 8 and 11, as expected. Although RED constructs were found to be distinct at Grades 8 and 11, we did not observe any significant differences in the negative correlations between corresponding aggressive and nonaggressive RED domains from Grade 8 to Grade 11, with the exception of emotional outcome expectancy. By Grade 11, adolescents were significantly more likely to expect different emotional outcomes from aggressive versus nonaggressive outcomes than they were in Grade 8. In other words, the difference between adolescents’ expectations of negative emotions to result from behaving aggressively and positive emotions to be experienced by responding nonaggressively increased across adolescence.

These child and adolescent trends of aggressive versus nonaggressive RED functioning were further evident in our analyses of RED difference scores (aggressive RED – nonaggressive RED values). From childhood through adolescence, there was a steady increase in the difference between evaluations of aggressive versus nonaggressive responses. This suggests that, as youths develop, their tendency to favor one response style over another increases from middle childhood through late adolescence.

Results support the hypothesis that the specified domains of aggressive and nonaggressive RED—namely, response efficacy, emotional outcome expectancy, and social outcome expectancy—are distinct in adolescence. Models that treated these six domains (three domains of both aggressive and nonaggressive RED) as two inclusive dimensions (i.e., aggressive vs. nonaggressive RED) fit the data less well than more differentiated models with respect to statistically accounting for variability in adolescent response decision making that is captured by treating the domains separately. The magnitude of most intercorrelations among specific aggressive and nonaggressive RED domains did not change across adolescent assessment waves, and results did not support the notion that there was significantly greater differentiation between RED domains from Grade 8 to Grade 11. Collectively, these results support a model of RED that distinguishes evaluative domains. Furthermore, findings support multiprocess hypotheses made by

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized factor loadings: Aggressive</th>
<th>Standardized factor loadings: Nonaggressive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 8</td>
<td>Grade 11</td>
</tr>
<tr>
<td></td>
<td>RE</td>
<td>EOE</td>
</tr>
<tr>
<td>Item-vignette no. 1</td>
<td>.42</td>
<td>.54</td>
</tr>
<tr>
<td>2</td>
<td>.66</td>
<td>.66</td>
</tr>
<tr>
<td>3</td>
<td>.64</td>
<td>.64</td>
</tr>
<tr>
<td>4</td>
<td>.78</td>
<td>.74</td>
</tr>
<tr>
<td>5</td>
<td>.70</td>
<td>.69</td>
</tr>
<tr>
<td>6</td>
<td>.72</td>
<td>.61</td>
</tr>
<tr>
<td>Reliability</td>
<td>.82</td>
<td>.81</td>
</tr>
</tbody>
</table>

Note. RE = response efficacy; EOE = emotional outcome expectancy; SOE = social outcome expectancy.
Fontaine and Dodge (2006), including distinctions between (a) evaluating actions and behavioral responses separately from anticipating outcomes of responses and (b) acknowledging different types of outcome expectancies (such as identifying social vs. emotional outcomes of a considered behavior) as distinct RED processes.

Development of the relation between RED and antisocial behavior. We found that the pattern of results in children’s general RED processing of aggressive versus nonaggressive responses (in Study 1) is considerably different from adolescents’ RED processing across specific domains (in Study 2). By Grade 8, all aggressive RED domains were moderately to highly correlated with antisocial behavior in the positive direction. In contrast, all nonaggressive RED domains were negatively correlated with antisocial conduct. In addition, RED domain difference scores (aggressive RED domains / their corresponding nonaggressive RED domains) were significantly correlated with antisocial behavior at Grades 8 and 11. This pattern of results emerged in Grade 11 as well. Findings suggest that in early adolescence, opposite relations between aggressive and nonaggressive RED and antisocial conduct problems are distinctive and that these relations are stable across adolescent development. Adolescents who evaluate aggressive responses to ambiguous provocations in favorable ways tend to be characterized by antisocial behavior; alternatively, nonaggressive adolescents are more likely to endorse nonaggressive responses and devalue aggressive response options during ambiguous provocation interactions. These findings are consistent with past literature that provided initial evidence for the relevance of aggressive and nonaggressive RED in the development of antisocial conduct problems. We did not, however, find any significant differences between the relations of any of the aggressive or nonaggressive RED domains from Grade 8 to Grade 11. Likewise, no relations between RED domain difference scores and antisocial conduct were significantly different across adolescent measurement waves. These results suggest that any change in variability in RED and behavior across adolescence was similar across these domains of functioning.

In contrast, we found that adolescents’ aggressive RED across all domains as well as their antisocial behavior decreased significantly from Grade 8 to Grade 11. That is, as adolescents developed, they were less likely to both evaluate aggressive responses favorably across RED domains and engage in antisocial behavior.

Table 4
Zero-Order Intercorrelations of Response Evaluation and Decision and Antisocial Constructs at Grades 8 and 11

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Antisoc G8</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Antisoc G11</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ARED G8</td>
<td></td>
<td>.40*</td>
<td>.39*</td>
<td>.57*</td>
<td>.39*</td>
<td>.87*</td>
</tr>
<tr>
<td>4. ARED G11</td>
<td></td>
<td>.30*</td>
<td>.53*</td>
<td></td>
<td>.57*</td>
<td></td>
</tr>
<tr>
<td>5. NRED G8</td>
<td></td>
<td></td>
<td></td>
<td>-.41**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. NRED G11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.70**</td>
<td>.10</td>
</tr>
</tbody>
</table>

Note. Antisoc = antisocial; G8 = Grade 8; G11 = Grade 11; ARED = aggressive response evaluation and decision; NRED = nonaggressive response evaluation and decision.

\* \* p < .01.

Figure 2. Cross-lagged model of aggressive response evaluation and decision (RED), nonaggressive RED, and antisocial behavior constructs in adolescence. d = disturbance. \* \* p < .05.
In addition, adolescents' nonaggressive RED, across all domains, increased across adolescence—that is, as adolescents developed they were more likely to favorably evaluate socially competent responses across RED domains. Taken together, these results suggest a collective increment in social maturity.

The observed pattern of the relation between RED and antisocial behavior is consistent with other research that has found that social cognition becomes more related with actual behavior across development (Davis-Kean et al., 2007; Huesmann & Guerra, 1997). Also, this study extends findings from previous analyses in the Child Development Project that examined SIP steps at a macroprocess level (early vs. late SIP step problems) in relation to youths' externalizing behavior (Lansford et al., 2006). Whereas Lansford et al. (2006) examined how SIP steps act in conjunction with one another and how corresponding SIP profiles may be used to differentiate groups of children and adolescents, the present study focused on the advanced step of RED at a microprocess level to investigate how youths' response decision making becomes internally consistent, differentiated, and related to concurrent antisocial behavior across childhood and adolescence.

General Discussion

Empirical studies of normative developmental changes in SIP have been few (Orolio de Castro, 2004; Mize & Pettit, in press). In addition, even in studies that have examined longitudinal data, developmental changes in SIP are normally not the scientific impetus (Orolio de Castro, 2004). For these and other reasons, scientists have increasingly been calling for studies that utilize longitudinal data to examine the relation of social cognition and antisocial behavior across time (e.g., Crick & Dodge, 1994; Egan, Monson, & Perry, 1998; Fontaine, 2006a, 2007; Fontaine & Dodge, 2006; Musher-Eizenman et al., 2004). In response, the present studies examined the development of aggressive and nonaggressive response decision making and externalizing behavior problems in a sample of 585 boys and girls across childhood (Study 1) and adolescence (Study 2).

Overall findings in Study 1 suggested that, although RED is internally consistent by kindergarten, RED is not consistently related to conduct problem behaviors during childhood. In the earliest of school years, children appear to have a general response style by which they evaluate different types of behaviors similarly across contexts (i.e., some children may evaluate aggressive and nonaggressive responses favorably, whereas others assess both types of responses less favorably). By Grade 3, though, differentiation of RED processing of alternative responses emerged, marked by a negative correlation of aggressive and nonaggressive RED.

In Study 2, our assessment of specific domains of RED processing—that is, response efficacy, emotional outcome expectancy, and social outcome expectancy—showed that a negative correlation of aggressive and nonaggressive RED persisted throughout adolescence. RED was represented as a multiprocess construct, and hypothesized RED domains were empirically differentiated. In addition, across all RED domains, RED was strongly associated with antisocial behavior, providing support for the notion that, although RED may not play a strong role in social functioning in childhood, its potential role in adolescent antisocial conduct is notable. Finally, Study 2 findings suggested that by Grade 11, adolescents’ antisocial functioning, at both social cognitive and behavioral levels, declines.

Collectively, these findings are important to understanding the development of SIP, and, more specifically, RED, in childhood and adolescence and the contribution that evaluating alternative types of responses to situations that pose social challenges may have in one's social and behavioral maturation. In addition, findings support the SIP hypothesis that advanced steps of processing not only become more developed and relevant as children enter and continue through adolescence but also may account for social cognitive and behavioral variability in ways that are important to understanding how adolescents make decisions in real time to enact certain behaviors over others. In this way, findings provide a critical step toward understanding the relevance and differentiation of RED as a multiprocess construct in youth antisocial development.

In general, empirical study of the development of SIP has been limited (Crick & Dodge, 1994; Mize & Pettit, in press). Although various issues related to the development of RED have received notable theoretical attention in recent years (e.g., Fontaine, 2008; Fontaine & Dodge, 2006), the role of development in children’s and adolescents’ evaluative judgments and decisions about alternative social behaviors remains in similar need of empirical examination. Scientific examination of the emergence, maturation, and differentiation of RED is critical not only to the specific interest of understanding a step of SIP that appears to be critical in adolescence but also to the general interest of better understanding the development of executive function, including moral judgment and reasoning.

Much empirical inquiry in moral development, exemplified by research guided by moral domains models in the Piagetian tradition (Piaget, 1965), has focused on social cognitive development. In contrast, much SIP research has been focused on the role of social cognitive operating in the development of social competence and aggressive behavior (for further discussion, see Arsenio & Lemerise, 2004; Dodge & Rabiner, 2004). Critical to the scientific study of moral development, though, are investigations that examine various aspects of moral development (i.e., social cognition and behavior) simultaneously across time. In this way, the studies reported herein may serve as a framework by which subsequent investigations that focus specifically on moral evaluation, decision making, and behavior may assess and analyze the emergence and development of children’s online response judgments and decisions in situations that are unclear as to their moral implications (i.e., ambiguous provocations).

Limitations

Some limitations of this investigation should be recognized. First, this study was based on early conceptualizations of the response decision step of SIP theory (see Crick & Dodge, 1994; Dodge, 1986; Mize & Pettit, in press). Early models of RED did not capture the range of processes that recent scholarship attributes to this level of SIP functioning (Fontaine & Dodge, 2006). As a result, this study did not assess multiple RED processes that may be critical to a complete test of the development of RED and its relation to antisocial behavior. This point is particularly valid with respect to the child assessments, as only one RED question was administered to participants during the first 4 years of this study.
The response valuation question may not attend to response decision-making processes that may be relevant to children’s social cognitive processing and aggressive conduct during early school years. Although additional RED questions were asked of participants during adolescence, a fuller range of RED processes was not assessed until Grade 11, leaving certain questions about RED development and differentiation unanswerable at present.

Second, this study may have benefited from administering a consistent set of RED questions across all youth ages. As Orobio de Castro and his colleagues (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002) found, it is difficult to compare data from studies of different age groups and the inconsistent patterns that emerge pose problems for interpretation. The response valuation question, assessed in childhood (kindergarten through Grade 3, in Study 1) was not assessed during adolescence, which limited our ability to assess developmental issues with respect to general RED processing of aggressive versus nonaggressive responses. Similarly, the RED questions that were asked across adolescent assessment waves (Grades 8 and 11, in Study 2), representing specific RED domains, had not been asked during child years. As a result, whereas both Studies 1 and 2 were longitudinal, differences in their respective methodologies limited our ability to interpret developmental patterns of results to doing so within each study.

Third, this study may be improved by timing assessment waves evenly across youth years or, at least, assessing RED and behavior more regularly after Grade 3. This study began by assessing RED and antisocial behavior on a yearly basis, which we believe was necessary because of the rapid growth in psychological functioning, and social cognitive skills, more specifically, that occurs in children during these early school years. However, assessing RED and behavior on a biyearly basis after Grade 3 may have allowed us to more comprehensively answer developmental questions about RED and the relation between RED and antisocial behavior with respect to later childhood and adolescence.

Another limitation is the correlational nature of the research design, which restricts the certainty of conclusions about the role of RED in causing antisocial behavior outcomes. Future research that uses an experimental design may be informed by findings from the present set of studies, including the developmental window during which manipulation of youths’ RED processing may be worth examining. Clearly, both types of investigation are critical to a more conclusive developmental picture.

Finally, it should be recognized that participants’ responses in the RED assessment may reflect processes other than online evaluative judgments of alternative behaviors. Participants’ ratings may reflect their evaluations of videotaped responses, the social acceptability of the different types of behaviors shown, or their expectations of how they would judge such behaviors if they were engaged in similar interpersonal situations in the future. As such, findings should be interpreted in light of these alternative meanings.

**Future Directions for Basic Science**

Some future directions for research stem directly from the limitations discussed in the previous section. For example, future studies of the development of RED may be guided by more recent, comprehensive models of RED processing, as discussed by Fontaine and Dodge (2006); assess the same set of RED domains across time; and measure RED and antisocial behavior more regularly across child and adolescent years. These adjustments may provide future studies with a greater potential to answer complicated developmental questions about the onset and differential maturation of RED domains during childhood.

However, other research directions more specifically follow from findings of the present study. For example, investigations of moral cognitive development in children may examine the degrees to which children are able to account for moral differences in alternative responses during provocation and other types of challenging and potentially stressful and threatening social interactions. One empirical question that remains unanswered involves when children become able to evaluate the degrees to which alternative responses are excusable and justifiable, given certain perceptions of benign, ambiguously provocative, and unambiguously provocative cues. Another developmental question asks when children begin to evaluate alternative responses across multiple domains and what domains may be included in children’s developing pool of evaluative domains.

Other research may investigate the degree to which RED accounts for variability in nonaggressive maladaptive outcomes, such as internalizing patterns that involve anxious and depressive problems (e.g., low self-esteem and loneliness) and passive and avoidant behavioral problems. Research has suggested that SIP theory is useful in accounting for individual differences in internalizing problems (e.g., Garber, Quiggle, Panak, & Dodge, 1991; Ingram, 1984; Quiggle, Garber, Panak, & Dodge, 1992), but no studies have examined the role of RED in the development of this form of maladjustment. Specifically, future studies may assess children’s and adolescents’ response decision making with respect to responses of withdrawal and submission to discern the role of RED in the development of internalizing problems and mood disorders.

**Future Directions for Intervention**

Findings from the present study may have considerable relevance for prevention and clinical intervention. At the prevention level, children might be taught social cognitive skills by which they can more positively evaluate and appreciate nonaggressive–competent responses to provocation situations and realize the negative aspects and consequences of aggressive retaliation and, more generally, acting in antisocial ways. In addition, children may become more behaviorally comfortable and skilled by practicing nonaggressive–competent behaviors during provocative and hostile social interactions, both with peers and adults. Learning these social cognitive and behavioral skills during early school years appears to be critical as it is during these years that present findings suggest RED plays less of a role in the child’s developing antisocial behavioral style.

At the intervention level, the same principles may be applied. However, antisocial behavior has been demonstrated to be particularly stable during adolescence (Adams, Bukowski, & Bagwell, 2005; Loeber & Hay, 1997; Olweus, 1979), so the clinician’s expectation as to the degree to which behavioral change will take place should be kept in perspective. Cognitive–behavioral treatments that incorporate strong behavioral decision making and social behavioral role playing components, though, may be rela-
tively more effective. Of course, these are empirical questions that should be tested via experimental intervention science.

Conclusion

The present set of longitudinal studies represents the first to examine relations between executive function processes (i.e., alternative response evaluation and decision making) and externalizing conduct problems across both childhood and adolescence. Findings support a developmental model that posits that as RED becomes more internally consistent and differentiated over time, its association with antisocial behavior grows. These developmental trends may have important implications for social cognitive theory of aggression as well as clinical intervention.

References


Received April 22, 2007
Revision received June 24, 2008
Accepted September 8, 2008