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Testing an Individual Systems Model of Response Evaluation and Decision (RED) and Antisocial Behavior Across Adolescence

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Abstract

This study examined the bidirectional development of aggressive response evaluation and decision (RED) and antisocial behavior across five time points in adolescence. Participants (n = 522) were asked to imagine themselves behaving aggressively while viewing videotaped ambiguous provocations and answered a set of RED questions following each aggressive retaliation (administered at Grades 8 and 11 [13 and 16 years, respectively]). Self- and mother reports of antisocial behavior were collected at Grades 7, 9/10, and 12 (12, 14/15, and 17 years, respectively). Using structural equation modeling, the study found a partial mediating effect at each hypothesized mediational path despite high stability of antisocial behavior across adolescence. Findings are consistent with an *individual systems* perspective by which adolescents' antisocial conduct influences how they evaluate aggressive interpersonal behaviors, which affects their future antisocial conduct.

Testing an Individual Systems Model of Response Evaluation and Decision (RED) and Antisocial Behavior Across Adolescence

In recent years, dynamic models of child and adolescent development have received increasing scholarly attention (e.g., Cicchetti, Toth, & Maughan, 2000; Crick & Dodge, 1994; Dodge & Pettit, 2003; Fontaine, 2006a; Sameroff & Chandler, 1975; Sameroff & MacKenzie, 2003; Shonkoff & Phillips, 2000). Several systems theories have informed scholarly thinking in this area, including general systems theory (von Bertalanffy, 1968; Sameroff, 1995), developmental systems theory (Ford &Lerner, 1992), transactional perspectives (Sameroff, 1987; Sameroff & MacKenzie, 2003), and dynamic systems approaches (Granic & Patterson, 2006; Lichtwarck-Aschoff & van Geert, 2004). Common

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to all these approaches is the principle of developmental bidirectionality by which systems influence each other in an iterative reciprocal manner across time. Whereas there have been repeated urges to scientifically test these models, empirical examinations have remained relatively limited (Crick & Dodge, 1994; Dodge & Pettit, 2003; Fontaine, 2006a; Fontaine & Dodge, 2006).

Most systems theories have emphasized person – environment interactions; a transactional perspective, for example, posits that an individual self-organizes and develops as a function of ongoing transactions with his or her environment. More recently, Fontaine (2006a) distinguished the importance of examining the developmental bidirectionality of individual (or *intra*personal) systems as well. An *individual systems* perspective of social cognition and behavior posits that behavior is proximally caused by social-cognitive operations (such as evaluating behavioral options) and that, in turn, behavioral enactments inform future social-cognitive processing. In this way, an individual systems approach may be used to examine how cognition and behavior may relate to, and influence, each other across development (e.g., Huesmann & Guerra, 1997).

In the present study, we investigated the bidirectional development of response evaluation and decision (RED; Fontaine & Dodge, 2006)—a model of evaluative judgment and decision making about social behavior—and antisocial behavior across adolescence. It was hypothesized that in a continuous, reciprocal, and iterative manner, adolescents' aggressive social behaviors influence future behavioral decision making and that, in turn, changes in response decision making proximally affect antisocial behavior. This hypothesis has been advanced for several years (Crick & Dodge, 1994; Fontaine & Dodge, 2006), though this study was the first to test it empirically. The hypothesis was approached from a social information processing (SIP) perspective (Crick & Dodge, 1994; Huesmann, 1998; Huesmann & Reynolds, 2001), which posits that antisocial behavior toward others develops via the cyclical processing of social cues and the social experiences that result from responding to, and interacting with, these cues. As is discussed in detail below, RED is an advanced stage of SIP during which individuals evaluate response options across multiple domains in order to decide how to respond in social situations. We focused on RED processing, in part, because of recent empirical evidence that RED may be particularly important to understanding the development and maintenance of antisocial conduct problems in adolescence (e.g., Fontaine, Burks, & Dodge, 2002; Shahinfar, Kupersmidt, & Matza, 2001). In addition, there Is an abundance of evidence that youth's executive function skills, including RED-related processes such as evaluative judgment and decision making, make considerable developmental gains as children enter adolescence and approach early adulthood (Cobb, 1992; Keating, 1980, 2004; Steinberg, 2005).

RED

SIP posits that behavioral outputs are the result of multiple series of on-line mental operations by which individuals are constantly "reading" incoming social information as they continue to interact with their environments. In their reformulated model, Crick and Dodge (1994) articulated five stages of processing that are potentially active prior to the enactment of a behavioral response. In response to a social cue, a responding individual (a) perceives and organizes various facets of the stimulus (*encoding of cues*), (b) interprets the meaning of the stimulus and makes attributions of causality and intent (*interpretation of cues*), (c) identifies his or her interests in the situation (*clarification of goals*), (d) generates one or more possible responses to the stimulus (*response access or construction*), and (e) assesses the generated response(s) across multiple domains in order to select a response for behavioral enactment (*response decision*). Numerous empirical studies have contributed scientific support for SIP at each of these five stages. The fifth step of SIP, response decision, is the most advanced stage of SIP in that it builds upon earlier SIP steps and

involves relatively sophisticated cognitive processes that are associated with executive function. In order to more fully process information at the level of response decision, a degree of cognitive development that is typical of later youth development may be required.

Recently, Fontaine and Dodge (2006) presented an elaborate process model of the response decision step (called *response evaluation and decision* or RED). This model poses multiple response decision-making processes and has been supported by evidence from a variety of independent research programs. RED provides a framework by which the development of behavioral decision making in challenging and potentially aversive social situations in childhood and adolescence may be explained.

In the RED model, it is posited that there are different kinds of outcomes that a responding individual may consider when deciding how to respond to a social stimulus in real time, a hypothesis that has been empirically supported in past investigations (for discussions, see Crick & Dodge, 1994; Fontaine, 2006b; Fontaine & Dodge, 2006). For instance, whereas a social outcome expectancy may ask "If I act in a hostile manner, how much will people like me?" an emotion outcome expectancy may ask "How will I feel if I respond aggressively?" and an instrumental outcome expectancy may ask "If I behave aggressively, will I get what I want?" Most research on aggressogenic outcome expectancies and antisocial behavior in youth has examined aggressive youths' various expectancies of different positive outcomes to result from their aggressive behaviors. For example, compared to their nonaggressive peers, aggressive youths have been found to expect aggressive conduct to lead to tangible rewards (Perry, Perry, & Rasmussen, 1986), power over their targets (Kennedy & Perry, 1993), better feelings about themselves (Slaby & Guerra, 1988), and less aversive treatment by others (Perry et al., 1986). These and other empirical findings have provided a foundation for the hypothesis that multiple outcome expectancies may play a role in youths' aggressogenic decision making.

In addition to alternative outcome expectancies, the importance of response efficacy judgments is stressed. The concept of response efficacy (originally "self-efficacy"; Bandura, 1977, 1982) is defined as the degree to which an individual believes that he or she can successfully carry out a considered behavior. The importance of self-efficacy judgments in social-cognitive models of aggressive behavior is well documented (e.g., Bandura, 1983; Crick & Dodge, 1994; Fontaine & Dodge, 2006; Huesmann, 1988). Multiple studies have found that compared to their nonaggressive peers, aggressive youths feel more confident about successfully carrying out aggressive acts (e.g., Erdley & Asher, 1996; Perry et al., 1986). In the present study, response efficacy as well as multiple outcome expectancies were the focus of the RED investigation.

Bidirectional Development of RED and Antisocial Behavior in Adolescence

Despite scientists' repeated emphasis on the importance of examining behavior-to-cognition pathways (e.g., Coie, 1990; Crick & Dodge, 1994; Ladd & Crick, 1989), the literature reflects a disproportionate focus on predicting behavior from individual differences in cognitive processes and structures (cf. Huesmann & Guerra, 1997). Among the exceptions, Fontaine et al. (2002) focused on the role of response decision processing in the development of adolescent externalizing problems and found that response decision making (a) was predicted by earlier externalizing behavior and (b) incremented the prediction of externalizing conduct problems from early to late adolescence. Although Fontaine et al.'s study did not examine the longitudinal reciprocal influence of response decision and externalizing conduct across adolescence, findings suggested that such bidirectional development should be examined.

As adolescents develop and their social worlds expand, they are faced with interpersonal challenges that may demand that response options be evaluated in light of a more complex array of social information and cues. Individual differences in how adolescents respond to similar social cues, as well as differences in how they experience similar social behaviors and exchanges, may influence how they evaluate behavioral options in the future. In reciprocal turn, their developing styles of evaluating such behaviors (including how confident they are in acting certain ways and what outcomes they expect to result) may influence the degree to which they subsequently engage in such behaviors.

The hypothesis that antisocial behavior influences subsequent social-cognitive processing is not a new one (Crick & Dodge, 1994). For example, engaging in aggressive behavior may enhance one's sense of efficacy for aggression and one's belief that aggression leads to tangible rewards (Fontaine & Dodge, 2006). However, empirical studies that are guided by this hypothesis are relatively few. This disproportionately unidirectional focus has limited scientific understanding of the role of judgment and decision processing in the development of antisocial behavior.

Also, it should be recognized that, in light of the high stability of antisocial behavior in adolescence (Adams, Bukowski, & Bagwell, 2005; Loeber & Hay, 1997; Olweus, 1979), there remains some question as to how flexible (and malleable) externalizing conduct patterns are during this developmental period. An individual systems perspective states that one's functioning continues to be shaped based on ongoing reciprocation between intrapersonal systems, such as social cognition and behavior. Consistent with this approach, RED has been posited as a model of response decision making that not only proximally affects behavioral outputs but also is subsequently informed and influenced by such outputs. A conceptual representation of an individual systems model of RED and antisocial behavior in adolescence is displayed in Figure 1.

Hypotheses

This investigation was guided by three main hypotheses. First, we hypothesized that RED partially mediates the development of antisocial behavior during early adolescence (Grades 7 to 9/10, Times 1 – 3). That is, adolescents' externalizing behaviors affect how evaluative judgments and decisions about future aggressive responses are made and, in turn, RED processing about aggressive responses affects change in antisocial behavior. Second, we hypothesized that antisocial behavior partially mediates change in aggressive RED (Grades 8 – 11, Times 2 – 4). In other words, adolescents' evaluative decision making about engaging in aggressive responses affects their antisocial behavior, which, in turn, is cognitively represented in ways such that it affects response decision making. Third, it was again hypothesized that aggressive RED partially mediates the development of antisocial behavior and this time in late adolescence (Grades 9/10 to 12, Times 3 – 5).

Method

Participants

In April 1987 and 1988, two cohorts of prekindergarten children were recruited to participate in a longitudinal study of the development of conduct problems (Child Development Project [CDP]; see Dodge, Bates, & Pettit, 1990; Dodge et al., 2003; Pettit, Bates, & Dodge, 1997). Participants were recruited from three geographic sites: Bloomington, IN; Knoxville, TN; and Nashville, TN. Parents were randomly approached during preregistration for kindergarten to request their participation in the study. Because approximately 15% of the children at targeted schools did not attend preregistration, a

corresponding percentage of participants were recruited by letter, by telephone, or on site on the first day of school. Of those recruited, approximately 75% agreed to participate.

At the first assessment, 585 families agreed to participate (48% female; 81% European American, 17% African American, and 2% other ethnic groups). Ethnicity and sex were assessed via mother reports mat were collected in Year 1 of the CDP. The Hollingshead (1979) index of families' socioeconomic status (SES) demonstrated a range of 11 – 66, the mean of which was in the low-middle class (M = 39.59, SD = 13.96). The present investigation began when the child participants were in Grade 7 and continued with yearly assessments through Grade 12 (n = 522, 89% of the original sample; 49% female; 82% European American, 16% African American, and 2% other ethnic groups).

Procedures and Measures

Antisocial behavior—The Youth Self-Report (YSR) and Child Behavior Checklist (CBCL; mother report) measures of *externalizing* problems were administered at Grades 7, 9/10, and 12 (Times 1, 3, and 5, respectively; scores from Grades 9 and 10 were combined to represent Time 3; Achenbach, 1991a, 1991b, 1991c). These measures have been established as having excellent reliability and validity in numerous empirical studies. Table 1 displays ranges, means, standard deviations, and zero-order correlations of CBCL and YSR externalizing scores by grade.

RED—Adolescents' aggressive RED was assessed at Grades 8 and 11 (Times 2 and 4, respectively) as part of an SIP protocol. The SIP assessment consisted of adolescents viewing a series of six video vignettes and imagining themselves as the protagonist in hypothetical ambiguous provocation situations. The vignettes were designed to capture varied social contexts that are typical in everyday adolescent life. Three of the six vignettes were gender neutral and three gender specific. That is, a total of nine video vignettes were constructed and used: three were viewed by the entire sample (gender-neutral scenarios), three were designed for and viewed solely by female participants (scenarios that are typical to everyday life for adolescent females), and three were designed for and viewed only by male participants (scenarios that are typical to everyday life for adolescent males). The ethnicity of the actors varied within and across vignettes.

Each vignette consisted of three segments, and participants answered evaluative questions that represent components of SIP following each segment. Questions were displayed on the video monitor as they were read aloud by the narrator; in addition, participants were presented with a printed paper copy of the questions and circled answers from a list of choices as the questions and possible answers were read aloud by the narrator. In the first segment of each video vignette, participants were asked to imagine themselves being presented with an ambiguous provocation. 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 take a closer look at 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 imagined themselves as the protagonist responding aggressively toward the ambiguous provocateur. In the backpack example, participants imagined themselves responding by saying, in an overtly hostile manner, "Look, I didn't know whose it was. I was just looking at it, okay?!?!" The third segment showed a nonaggressive socially competent response to the ambiguous provocateur. All vignettes viewed by female and male participants portrayed provocateurs and protagonists who varied according to ethnicity and gender.

The current study focused on participants' responses to the RED questions about the aggressive response viewed in the second segment of each vignette. Three questions that

represent conceptual domains of RED followed each of the six aggressive responses: (a) How easy would it be for you to act like this? ("response efficacy" [RE]; 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" [EOE]; 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" [SOE]; 5-point scale from *very much* to *not at all*). Participants' answers to individual RED questions were coded such that high values represented endorsement of the aggressive behavior being considered. Scores for each RED domain were averaged across the 6 vignettes. Table 2 displays alphas, ranges, means, standard deviations, and zero-order correlations of RED domains.

A fourth RED question was asked that was designed to assess participants' *instrumental* outcome expectancy. Unlike the other RED questions that were framed identically across vignettes, the instrumental outcome expectancy question was framed with specific reference 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 ($\alpha = .30$) and 11 ($\alpha = .08$); 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 in order to maintain consistency in measurement of the RED latent construct across Grades 8 and 11.

Analysis Plan

We used structural equation modeling (SEM) to examine our hypotheses. The models in this study were estimated with the latent variable modeling program *Mplus* 4.1 (Muthén & Muthén, 1998–2006) in the two-step approach advanced by Anderson and Gerbing (1988). First, confirmatory factor analyses were conducted to examine the measurement of the latent constructs over time in order to create optimal indices (as opposed to using scaled scores) of adolescents' behavior and RED (see Wright, 1999, p. 71, for a discussion of why latent variables are preferred over scaled scores). All items in the externalizing problems scale of the YSR and CBCL were included. Odd – even splits of items were used to create two YSR parcels and two CBCL parcels, for a total of four composite indicators. For the sake of parsimony and measurement reliability, the four indictors at Grade 9 and the four indicators at Grade 10 were combined to measure one latent construct representing externalizing conduct problems at Time 3. Indicators of the aggressive RED construct were the mean scores of RED domains (listed above: RE, EOE, and SOE) across the six video vignettes. Errors of parallel indicators and some nonparallel indicators were allowed to be correlated in order to improve the model fit. The estimation method used was maximum likelihood. Missing values were handled with the expectation maximization algorithm in *Mplus*. Measurement invariance (Horn & McArdle, 1992) was tested sequentially by comparing the initial (baseline) model with an alternative model that had factor loadings of parallel indicators that were constrained to be equal over time in terms of chi-square difference corresponding to the difference in the degrees of freedom. With the majority of loadings being invariant, the constructs were measured as comparable over time.

Second, three structural equation models were estimated: (a) the conceptual model with covariates of race, gender, and SES; (b) a model of only the direct effects; and (c) the final model with all direct and mediational effects. We estimated a model of only the direct effects in addition to the final model so that we would later be able to measure changes in

direct effects via comparison of the path coefficients of the two models. The final model also allowed us to test all mediational effects simultaneously through the indirect effect test integrated in the *Mplus* program. It should be noted that preliminary analyses found that none of the covariates (gender, race, and SES) had a significant effect on any of the mediational paths; thus, these covariates were not included in further model testing.

Results

The baseline measurement model was found to fit the data fairly: $\chi^2 = 649.41$, $df = 180$, $p < .001$, comparative fit index (CPI) = .93, Tucker – Lewis index (TLI) = .91, root mean square error of approximation (RMSEA) = .071 ± .006. Table 3 shows variances, covariances, and standardized factor loadings of the construct indicators (note that this table is provided primarily for the purposes of replication, alternative model comparison, and meta-analysis).

RED factor loadings ranged from .73 to .89. The loadings of the externalizing construct indicators ranged from .26 to .95, with two of the lowest loadings attributed to self-reports at Grade 7 (.26 and .32) and one attributed to mother reports at Grade 9 (.39; these loadings are marked by an asterisk in Table 3). A test of the measurement invariance of the RED constructs showed that loadings of the RED indicators were invariant over time ($\chi^2_{dif} = .40$, $df_{dif} = 2$, $p > .05$). A test of the measurement invariance of the externalizing constructs showed that the majority of factor loadings were invariant over time ($\chi^2_{dif} = 13.30$, $df_{dif} = 6$, $p > .05$), whereas the three low loadings mentioned above showed differences from later years. Overall, the constructs were found to be measured similarly and their interrelations to be unbiased by measurement.

Prior to estimating the theoretical model, we estimated a model of only the direct effects. We wanted to examine the stability of the univariate trajectories of antisocial behavior and aggressive RED across adolescence. Figure 2 illustrates our findings of direct effects: $\beta_2 = .81$ ($z = 18.55$, $p <. 001$), $\beta_6 = .93$ ($z = 15.67$, $p <.001$), and $\beta_4 = .54$ ($z = 8.99$, $p <.001$).

This model fits the data fairly: $\chi^2 = 649.79$, $df = 185$, $p < .001$, CFI = .94, TLI = .92, RMSEA = .064 ± .005. Antisocial behavior was found to be highly stable between Times 1 and 3 and between Times 3 and 5. This finding is consistent with past studies that have found antisocial problems to be highly stable during adolescence. In addition, aggressive RED was observed to be stable between Times 2 and 4.

The final model is displayed in Figure 3. The goodness-of-fit indices show that the hypothesized model with all direct and mediational effects fits the data fairly ($\chi^2 = 632.65$, $df = 183$, $p < .001$, CFI = .94, TLI = .92, RMSEA = .064 ± .005) and better than the model of only direct effects ($\chi^2_{dif} = 17.14$, $df_{dif} = 2$, $p < .01$). All the structural coefficients shown in Figure 3 were significantly different from zero ($z > 2.00$, $p < .05$). We tested the final model with a two-group SEM (males and females) and found that none of the seven structural parameters significantly differed for males and females ($\chi^2_{dif} = 11.68$, $df_{dif} = 7$, *ns*).

Tests of the three hypothesized mediational effects are illustrated in Figures 4 – 6. In each figure, the partial mediating effect is represented by both (a) the standardized indirect effect (or z score) and (b) the drop in beta weight of the direct effect (or $\Delta\beta$) on accounting for the indirect effect. We found that all indirect effects were significantly different from zero, with $\beta_1 \times \beta_3 = .03$ ($z = 2.29$, $p = .01$; Figure 4), $\beta_3 \times \beta_5 = .02$ ($z = 1.99$, $p = .02$; Figure 5), and $\beta_5 \times \beta_7 = .04$ ($z = 2.60$, $p < .01$; Figure 6), demonstrating a partial mediational effect at each hypothesized mediational path. These partial mediational effects are further illustrated by

the drop in beta weight of each direct effect: 4%, 13%, and 6% in Figures 4, 5, and 6, respectively.

Additional models were estimated by which the roles of RE, EOE, and SOE were individually examined, as well as the roles of mother- and self-reported aggression and delinquency (CBCL and YSR Aggressive and Delinquent narrowband scales, respectively). Results of each of these models were consistent with the hypothesized final model of the inclusive latent constructs of antisocial behavior and RED. Results of these additional tests suggested that no single domain of RED, nor report of aggressive or delinquent problems, was solely responsible for any of the mediational effects that emerged upon testing the hypothesized final model.

Discussion

Findings of this study are among the first ever to be based on prospective data that support a longitudinal reciprocal influence model of the development of social cognition and behavior. Adolescents' patterns of RED predicted later antisocial conduct problems even after prior antisocial behavior was controlled, and antisocial behavior predicted later patterns of RED even after prior RED was controlled. Consistent with an individual systems perspective (Fontaine, 2006a), empirical evidence in favor of all the proposed hypotheses was found in the present study. Three mediational paths were hypothesized, representing developmental reciprocation between aggressive RED and antisocial conduct problems from early to late adolescence. Partial mediation at each hypothesized time point was observed. Particularly noteworthy is that aggressive RED partially mediated the development of externalizing behavior in both early and late adolescence. Considered together, these findings are critical because they support a developmental model of longitudinal reciprocal influence between aggressive RED and antisocial conduct problems *throughout* adolescence, a stage of development in which SIP has been relatively understudied.

The importance of finding bidirectional effects is considerable. There has remained a clear imbalance in the literature that has favored the examination of cognition-to-behavior effects and neglected behavior-to-cognition developmental sequences. There are multiple reasons why it is critical to investigate ways by which social-cognitive processing may be affected by social behavior. Perhaps most obvious is that it is, by definition, impossible to understand the role of social cognition in human development if the ways in which social cognition forms and changes as a function of one's behavior are not identified and understood. For example, processes by which social-cognitive styles are shaped may be essential to understanding adolescents' formation of their self-identities and self-concepts (e.g., Fontaine, 2007; Harter, 2006; Harter, Bresnick, Bouchey, & Whitesell, 1997; Oyserman & Packer, 1996; Tesser, Wood, & Stapel, 2005), an aspect of adolescent maturation that has been argued to be of particular importance to adaptive life course development (Chiam, 1987; Gecas & Mortimer, 1987; Hart & Yates, 1997; Suls, 1989).

SIP theory posits that information about one's behaviors, and the social results that such behaviors lead to, is organized, represented, and stored as knowledge structures in one's cognitive database (or memory). These stored social representations may be drawn upon in future situations and used to inform behavioral evaluation and decision making during interactions in which these knowledge structures are deemed to be sufficiently relevant. This sequence is illustrated by the youth who stands up to a perceived bully by violently retaliating against his provocation. The youth may see that the bully backs down and, as a result, that he receives greater respect from his peers at school. In this way, the Sink between aggressive retaliation and favorable social outcomes may become represented in the youth's memory as a knowledge structure to be potentially activated during similar future

interactions, Findings of the present study are consistent with this hypothesized sequence, a core premise of SIP theory.

Findings are also consistent with studies of the role of executive function in the development of adolescents' antisocial conduct problems. Researchers have identified early adolescence as a period during which notable gains in multiple advanced cognitive abilities, including self-regulatory cognitive operations, judgment, and decision making, are made (Cobb, 1992; Keating, 1980, 2004; Steinberg, 2005). With respect to RED, other studies have found that this advanced SIP stage does not play as strong a role as in the development of conduct problem behaviors during early childhood (e.g., Fontaine, Yang, Dodge, Pettit, & Bates, 2007).

In both early and late adolescence, RED was found to account for residualized variance that was not otherwise explained by rank-order stability in externalizing conduct problems. Using SEM allowed us to examine and detect the influence of RED on antisocial behavior at Times 3 and 5 controlling for behavior at Times 1 and 3, respectively. In fact, SEM affords several advantages over some alternative methods that have traditionally been used to examine bidirectional processes. First, SEM enables one to obtain purified measures of hypothesized latent constructs (in our study, aggressive RED and antisocial behavior) by partitioning variances of measurement errors. Second, measurement invariance may be tested to ensure that the relations among the constructs are not contaminated by measurement. Third, SEM allows one to estimate and test multiple reciprocal processes simultaneously so that the chance of randomly finding a significant effect is reduced (as compared with multiple regression analysis).

Larger effect sizes were not expected for a number of reasons. First, the model of RED that was examined in the current study was based on an early conceptualization of the response decision step of SIP (Crick & Dodge, 1994). As a result, it did not include multiple processes that have since been hypothesized to play important roles in RED processing (Fontaine & Dodge, 2006). Second, RED represents one stage of SIP, and it maybe the case that adolescents' antisocial development involves other aspects of SIP. Third, antisocial behavior has been demonstrated to be particularly stable during adolescence, a finding that was replicated in the current examination. This finding suggests that change in adolescents' antisocial conduct is limited.

Although a comprehensive discussion that compares the hypothesized model with alternative perspectives of youth conduct problems is beyond the scope of this article, findings should be considered in light of at least two other approaches to studying the development of antisocial behavior. First, Huesmann and Guerra (1997) investigated the longitudinal relation between normative beliefs about aggression and aggressive behavior in disadvantaged elementary school children. They hypothesized that aggressive individuals should have individualized cognitive standards that approve of aggressive behavior and that people whose normative beliefs more strongly favor aggression should become more aggressive in their behavioral enactments. Their findings supported these hypotheses in that, in younger children (Grades 1 – 3), aggressive behavior predicted normative beliefs about aggression and, in older children (Grades 4 – 6), aggressive behavior was predicted by earlier reports of normative beliefs endorsing aggression. These findings were interpreted to reflect developmental differences in cognitive processing such that first graders develop normative beliefs about aggression via enactive and social learning and reinforcement and as children develop, their normative beliefs become crystallized, more resistant to change, and predictive of subsequent aggression.

In contrast with Huesmann and Guerra's (1997) study of the developmental relation between off-line cognitive structures (normative beliefs about aggression) and aggressive behavior in younger children from poor urban neighborhoods, we were interested in the longitudinal reciprocal relation between on-line processing (aggressive RED) and antisocial behavior in a community sample of adolescents. We, too, interpret our findings to be consistent with a model of learning and development in youth. As adolescents ascend through middle and high school years, approach graduation and adulthood, and prepare to apply for jobs and to postsecondary education, the range of their individual and social experiences expands. As such, they learn from their behaviors across varied situations in ways that inform how they evaluate these and related behaviors in the future, and, in reciprocal turn, their behavioral judgments in different contexts affect how they behave subsequently. Although the present study examined correlational nonexperimental data, findings are consistent with a learning model by which developmental interaction between on-line behavioral judgments and antisocial enactments is characterized by iterative reciprocal influence.

Findings may also be contrasted with the peer confluence model advanced by Dishion, Patterson, and Griesler (1994) by which the child's enactments of antisocial behavior are framed in the context of his or her developing social relationships and friendships. This model suggests that the child who behaves antisocially may be more likely to be rejected by prosocial peers and accepted by antisocial peers, which may serve to reinforce and strengthen an already emergent pattern of externalizing problems. With respect to our model, Dishion et al.'s confluence framework might lead one to question whether, of the three RED domains that were examined, social outcome expectancy is particularly responsible for mediation between early aggression and later, more general antisocial behavior. Although current findings may not be interpreted to support this specific hypothesis, we believe that such a hypothesis may be important to examining the transactional development of preadolescent children as they enter a more expansive interpersonal world in which they are faced with the complexities of changing social identity and group belonging.

Some limitations of the current study and directions for future research need to be acknowledged. First, the unit of analysis in the current study was 1 year (or 2 years in the case of Time 3). Reciprocal effects of cognitive processes and behavioral enactments in social situations, though, likely occur, and are ongoing, much more quickly than are herein represented. Many interchanges may take place in a matter of minutes or even seconds or microseconds. It may be that multiple exchanges between one's cognitive operating and behavior occur during a single interpersonal exchange (or series of interpersonal exchanges). Methodologies that are able to examine and capture reciprocal effects that occur more proximally according to these real-time social interactions are needed so that we can better understand the natural unfolding and development of the dynamic relation of social cognition and behavioral exchange. Future research may be conducted such that decision making and behavior are measured more frequently across shorter time intervals.

Second, this study could be enhanced by including a peer or authority figure measure that assessed, from a source that was external to the adolescent participants, how adolescents' antisocial behavior enactments are viewed and experienced by members of the adolescents' environments. Inclusion of such data would inform this study in that person – environment transactions may be examined in light of individual systems development and vice versa. Although this study empirically examined the interplay of multiple levels within the macrosystem of youth social functioning, it would be further useful to investigate the role of this bidirectional relation in a larger framework of transactional development (Fontaine, 2006a; Sameroff & MacKenzie, 2003).

Although standards for goodness of fit in SEM are not widely agreed upon, it should be acknowledged that the fit of the measurement model (as well as the other models that were estimated) was not particularly strong. Although current model fit may be described as *reasonable* or *fair* (Browne & Cudeck, 1993, p. 144), it may be improved upon in an examination of a more complete, current assessment of RED or by including measures of environmental responsivity to antisocial behavior.

The current study also has implications for intervention with adolescents who exhibit patterns of conduct problem behaviors. Findings suggest that adolescents' behavioral decision making may play a role in their antisocial functioning throughout adolescence. Given the remarkable stability of antisocial behavior during adolescence, interventions with antisocial teens may realize greater effects if they focus on processes that are consistent with the RED model. For instance, adolescents' antisocial behavior may be reduced if they are better able to evaluate a fuller spectrum of social and personal outcomes of their aggressive actions. If adolescents are taught how to be more aware of negative personal and social consequences of antisocial conduct, they maybe able to make more appropriate behavioral evaluations and decisions during future social interactions in which the idea of behaving aggressively comes to mind.

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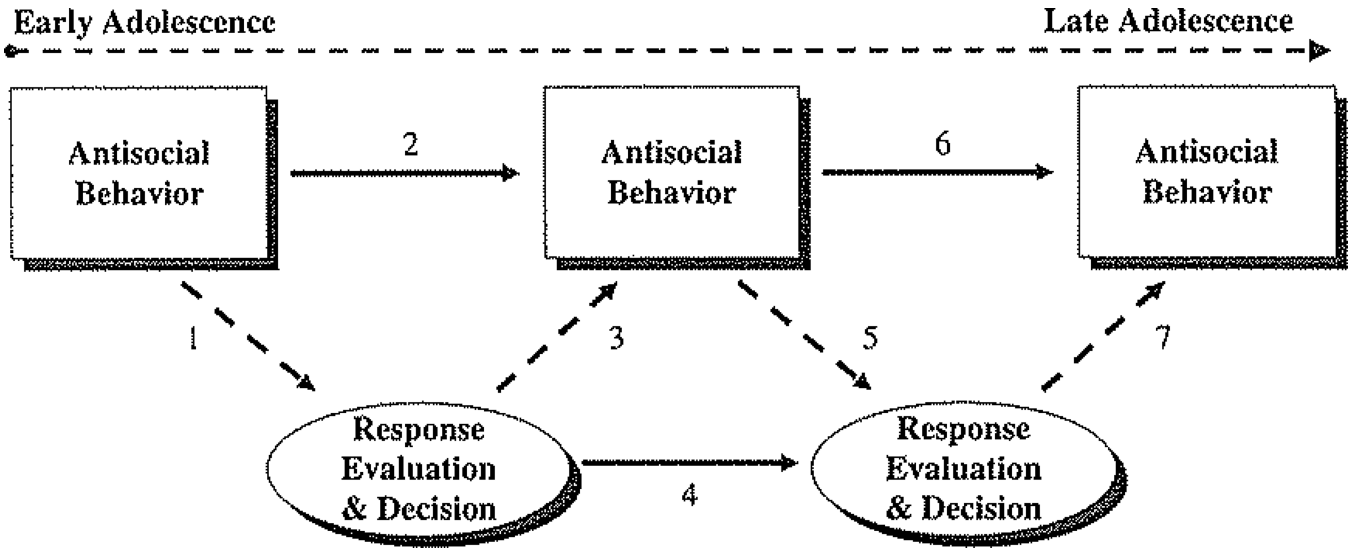

Figure 1.
Theoretical model.

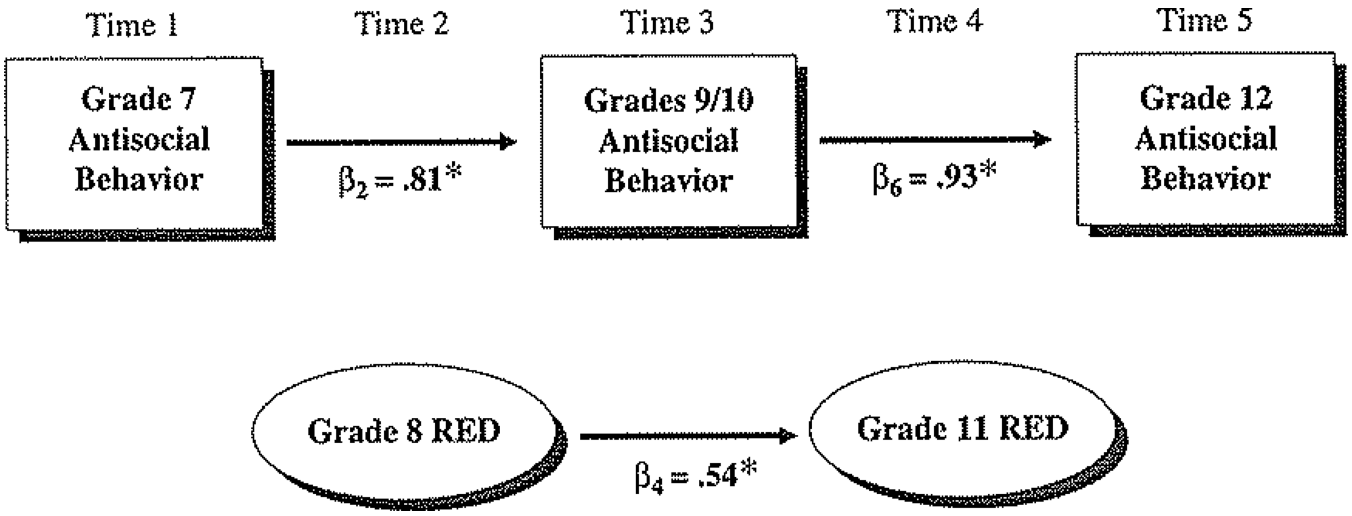

Figure 2.
Stability of univariate trajectories of antisocial behavior and aggressive response evaluation and decision (RED).
Note. *indicates RED factor loadings.

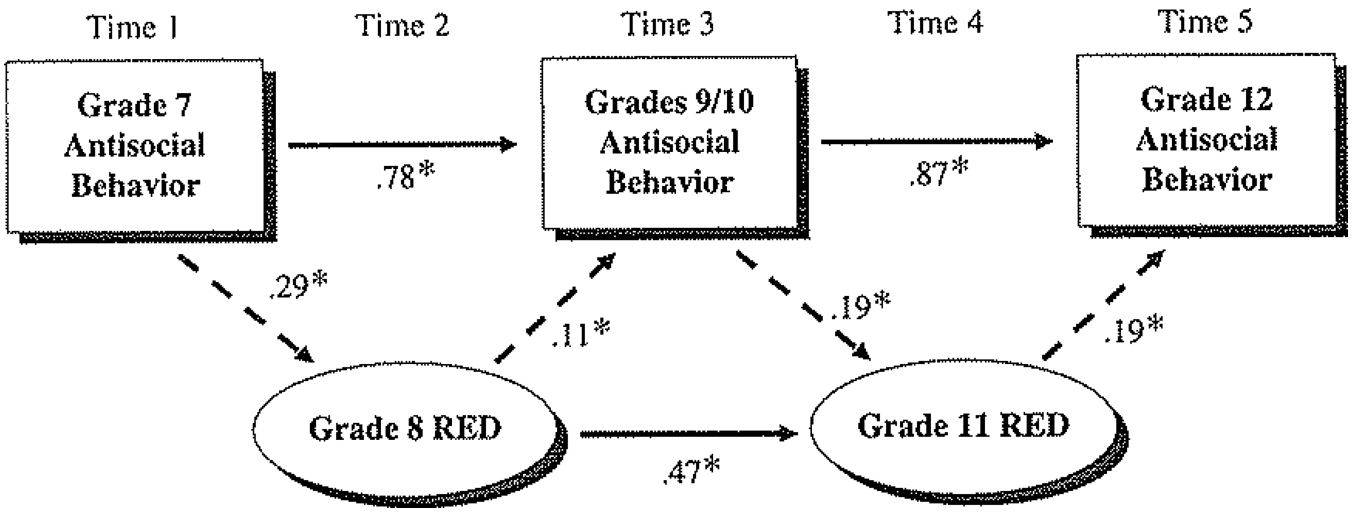

Figure 3.
Hypothesized model with structural parameter estimates.
Note. RED = response evaluation and decision. *indicates RED factor loadings.

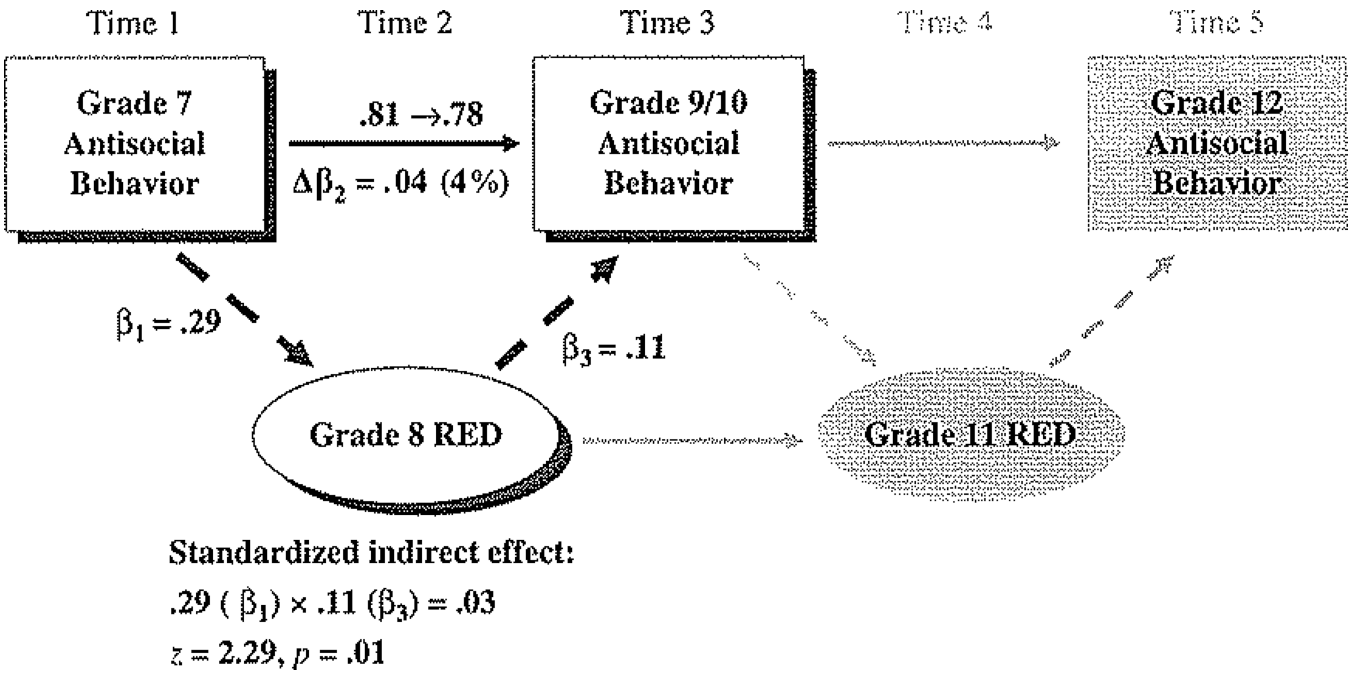

Figure 4.
Mediational Path 1 (Times 1 – 3): Partial mediational effect of aggressive response evaluation and decision (RED) on the development of antisocial behavior in early adolescence.

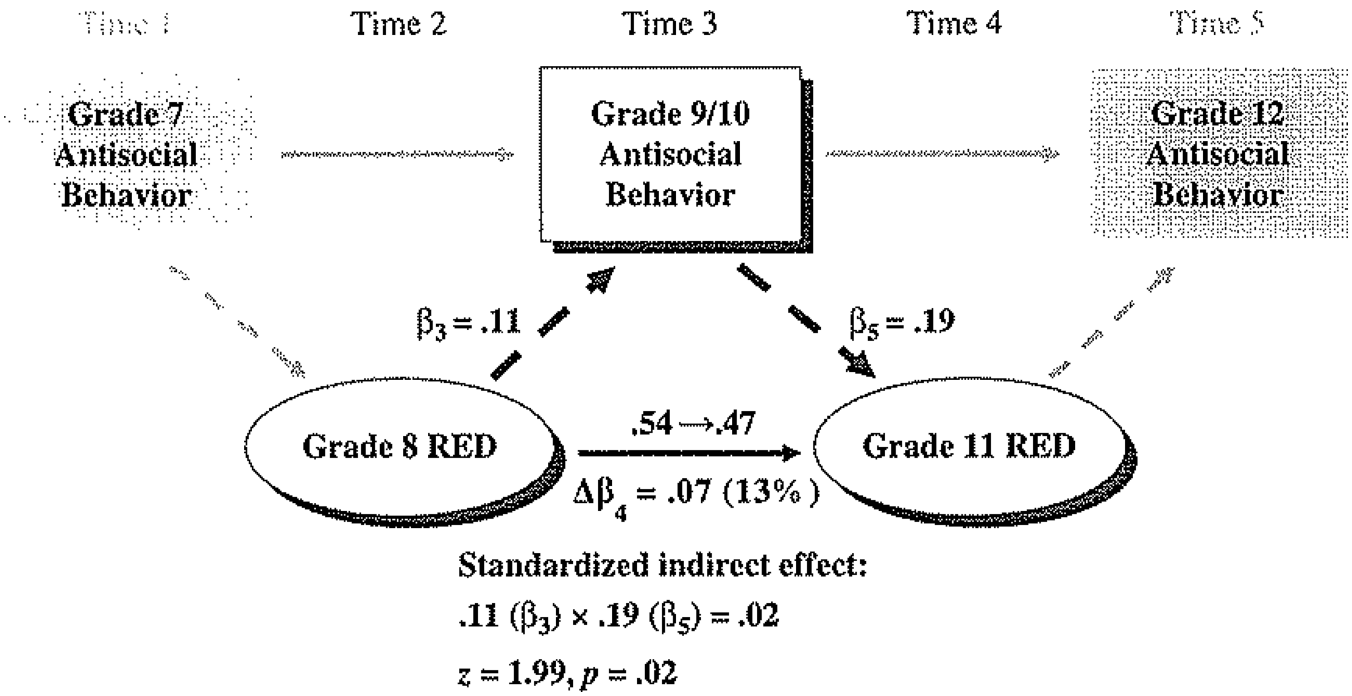

Figure 5.
Mediational Path 2 (Times 2 – 4): Partial mediational effect of antisocial behavior on the development of aggressive response evaluation and decision (RED).

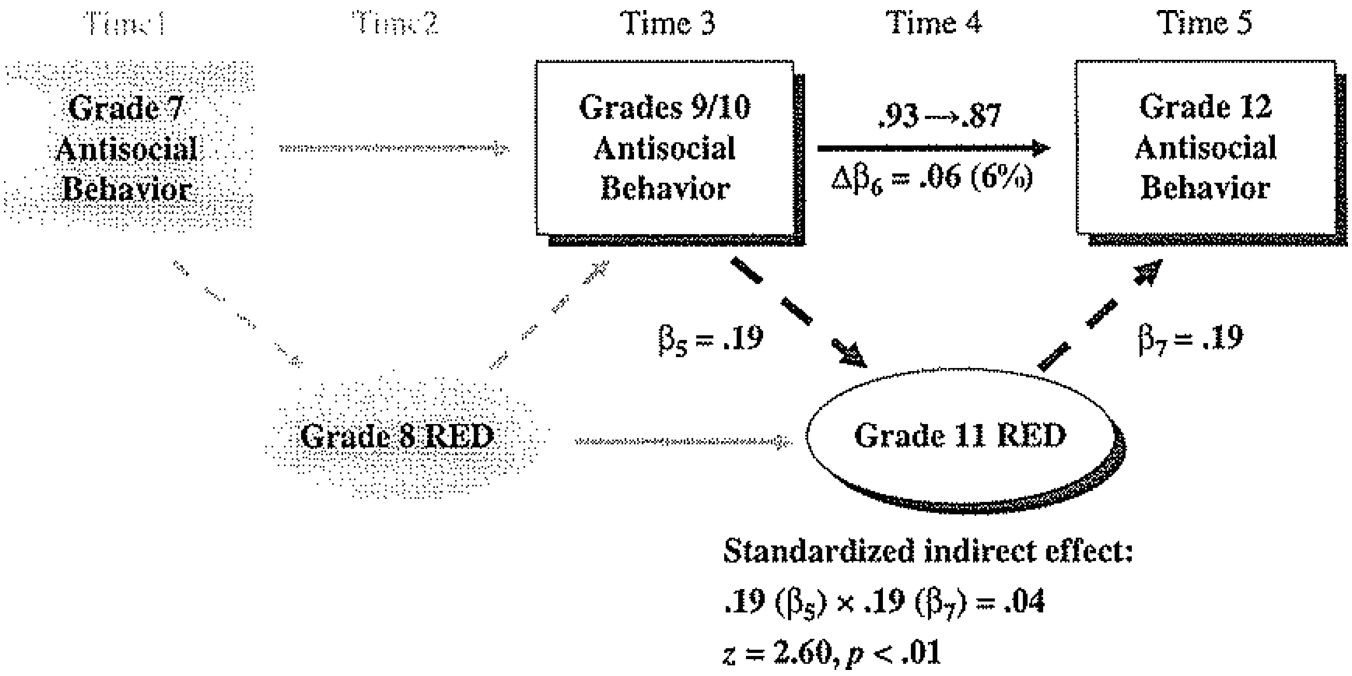

Figure 6.
Mediational Path 3 (Times 3 – 5): Partial mediational effect of aggressive response evaluation and decision (RED) on the development of antisocial behavior in late adolescence.

Table 1

Descriptive Statistics and Correlations of CBCL and YSR Externalizing Scores by Grade

	Range	*M* (*SD*)	2	3	4	5	6	7	8
Time 1									
1. Grade 7 CBCL	0–40	9.24 (7.14)	.27	.73	.36	.66	.38	.63	.34
2. Grade 7 YSR	0–38	11.11 (6.42)		.35	.51	.32	.41	.24	.37
Time 3									
3. Grade 9 CBCL	0–50	8.20 (8.16)			.47	.79	.46	.68	.38
4. Grade 9 YSR	0–48	10.46 (6.72)				.42	.72	.35	.59
5. Grade 10 CBCL	0–60	7.83 (8.07)					.48	.67	.34
6. Grade 10 YSR	0–39	10.99 (6.98)						.39	.68
Time 5									
7. Grade 12 CBCL	0–46	7.19 (7.62)							.43
8. Grade 12 YSR	0–39	9.54 (6.94)							

Note. All correlations are significant at $p < .001$. CBCL = Child Behavior Checklist; YSR = Youth Self-Report.

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Table 2

Descriptive Statistics and Correlations of RED Domains by Grade

	Alpha	Range	*M* (*SD*)	2	3	4	5	6
Grade 8 (Time 2)								
1. Response efficacy	.82	1.00–5.00	2.22 (0.84)	.70	.55	.45	.36	.24
2. Emotion outcome expectancy	.81	1.00–4.17	2.03 (0.58)		.66	.42	.47	.28
3. Social outcome expectancy	.80	1.00–4.83	1.99 (0.62)			.33	.32	.32
Grade 11 (Time 4)								
4. Response efficacy	.87	1.00–5.00	2.02 (0.77)				.75	.64
5. Emotion outcome expectancy	.87	1.00–4.33	1.86 (0.61)					.67
6. Social outcome expectancy	.84	1.00–4.50	1.65 (0.59)					

Note. All correlations are significant at $p < .001$. RED = response evaluation and decision.

Table 3

Variances (on the Diagonal), Covariances, and Factor Loadings of the Construct Indicators

Grade/ parcel		RE	EOE	SOE	RE	EOE	SOE	CP1	CP2	YP1	YP2	CP1	CP2	YP1	YP2	CP1	CP2	YP1	YP2	CP1	CP2	YP1	YP2	Loading
Grade 8	RE	25.72																						.79
	EOE	12.44	12.22																					.89
	SOE	10.47	8.67	14.04																				.73
Grade 11	RE	11.68	7.06	6.36	21.61																			.87
	EOE	6.92	6.22	4.83	12.71	13.43																		.88
	SOE	4.93	3.99	4.65	10.65	8.93	12.84																	.75
Grade 7	CP1	5.97	2.50	3.30	4.66	2.59	3.80	18.24																.86
	CP2	3.59	1.52	2.17	3.04	1.37	1.97	11.07	9.59															.95
	YP1	7.21	2.94	3.89	4.59	1.71	2.54	2.61	2.05	12.38														.32*
	YP2	6.65	2.72	3.12	3.88	0.83	1.43	4.66	3.16	8.90	12.55													.26*
Grade 9/10	CP1	6.25	2.71	3.38	6.29	2.15	3.95	14.35	9.73	4.49	6.48	22.84												.83
	CP2	4.76	2.37	3.09	4.78	1.79	3.32	9.67	7.43	3.32	4.71	12.20	12.66											.89
	YP1	5.46	3.20	3.18	5.52	2.25	3.20	12.69	8.56	4.37	5.46	17.26	12.04	22.14										.82
	YP2	4.36	2.78	2.70	4.61	1.92	2.68	8.79	6.78	3.58	4.05	12.10	9.63	14.86	12.81									.85
	CP1	5.70	2.36	3.19	6.05	1.96	3.24	4.19	3.270	5.74	5.33	7.01	5.73	5.79	4.92	13.59								.52
	CP2	6.27	2.28	3.01	4.78	1.94	2.39	5.76	4.15	5.31	6.99	8.00	6.00	6.37	5.10	10.48	12.84							.39*
	YP1	5.31	3.69	3.80	7.66	4.57	5.70	5.69	3.67	5.17	4.33	7.18	5.51	7.94	6.92	10.14	8.57	16.97						.57
	YP2	5.60	3.57	4.00	7.44	3.71	5.40	7.16	4.44	4.37	5.29	8.68	6.35	9.11	7.20	9.64	9.82	14.32	16.46					.43
Grade 12	CP1	4.01	2.96	2.40	5.39	2.07	3.17	10.63	7.20	2.41	3.73	13.00	8.70	13.17	8.79	4.09	4.90	6.33	6.65	17.33				.74
	CP2	3.07	2.66	2.18	4.68	1.89	3.22	8.64	6.23	2.26	3.23	10.62	7.99	10.33	7.87	3.73	4.27	5.57	6.05	13.19	12.91			.74
	YP1	3.60	1.83	2.80	7.09	3.08	5.18	4.54	2.93	3.81	1.10	6.13	4.67	5.26	4.11	7.35	6.14	10.55	9.52	5.52	5.12	12.45		.56
	YP2	4.70	2.57	3.05	8.24	3.86	5.75	5.23	3.35	3.90	4.86	7.17	5.20	5.90	.46	7.40	7.44	10.60	10.66	6.60	5.69	11.56	15.18	.41

Note. RE = response efficacy; EOE = emotion outcome expectancy; SOE = social outcome expectancy; CP1 = Child Behavior Checklist (CBCL) Parcel 1; CP2 = CBCL Parcel 2; YP1 = Youth Self-Report (YSR) Parcel 1; YP2 = YSR Parcel 2.