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Does Response Evaluation and Decision (RED) Mediate the Relation between Hostile Attributional Style and Antisocial Behavior in Adolescence?

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Abstract

The role of hostile attributional style (HAS) in antisocial development has been well-documented. We analyzed longitudinal data on 585 youths (48% female; 19% ethnic minority) to test the hypothesis that response evaluation and decision (RED) mediates the relation between HAS and antisocial behavior in adolescence. In Grades 10 and 12, adolescent participants and their parents reported participants' antisocial conduct. In Grade 11, participants were asked to imagine themselves in videotaped ambiguous-provocation scenarios. Segment 1 of each scenario presented an ambiguous provocation, after which participants answered HAS questions. In segment 2, participants were asked to imagine themselves responding aggressively to the provocateur, after which RED was assessed. Structural equation modeling indicated that RED mediates the relation between HAS and subsequent antisocial conduct, controlling for previous misconduct. Findings are consistent with research on the development of executive function processes in adolescence, and suggest that the relation between HAS and RED changes after childhood.

Keywords

Social cognition; Social information processing; Hostile attributional style; Decision making; Aggression; Antisocial behavior; Adolescence

During the past quarter century, social information processing (SIP) models have received a considerable amount of theoretical and empirical attention (Crick and Dodge 1994; Dodge 1980; Fontaine 2006; Huesmann 1998; McFall 1982). The SIP model advanced by Crick and Dodge (1994) proposes a series of social-cognitive and cognitive-emotional processes (or steps) in the development of social competence and behavior across the life course. In the first step, the individual perceives and organizes information about the social stimulus (*encoding of cues*). The individual then makes attributions of causation, affect, and intent to the stimulus and assesses the relevance of the stimulus to his or her own personal well-being (*interpretation of cues*). Next, the individual identifies his or her goals to which the situation at hand may relate (*clarification of goals*). Fourth, the responding individual generates one or more responses, either by constructing responses anew or by accessing previously constructed responses from memory (*response access or construction*). Fifth and finally, the responding individual assesses his or her response options across evaluative domains in order to select a response for behavioral enactment (*response decision*).

A considerable literature has been dedicated to the role of SIP mechanisms in the development of aggressive and delinquent conduct problems in youth. Empirical support for each step of SIP has been demonstrated, though two sets of processes have commanded particularly extensive attention—a set of early processes that focus on “reading” and making meaning of the presented stimulus, and later processes that consider responding aggressively to cues that leave open the question as to their provocative content. These SIP components, primarily represented by the steps of *interpretation of cues* and *response decision*, respectively, have repeatedly been found to play important roles in scientific understanding of the relation between social information processing and aggressive behavior in children and adolescents (for recent reviews, see Fontaine and Dodge 2006; Orobio de Castro et al. 2002).

Research on the early steps of SIP has shown that children who tend to believe harmful outcomes are purposefully caused by others engage in more aggressive behavior than do their peers who view such outcomes as accidental (e.g. Dodge 1980; Dodge et al. 1986). Furthermore, aggressive children are more likely to attribute hostile and mean-spirited content to social cues that are ambiguous with respect to their underlying intentions (e.g., Dodge 1980; Trachtenberg and Viken 1994). That is, in situations in which it is unclear as to the intent of the stimulus actor and the meaning of the cue, aggressive youths are inclined to interpret them as provocative (e.g., Crick 1995; Halligan et al. 2007). This finding has been replicated across varied populations, contexts, and developmental periods (Orobio de Castro et al. 2002). The phenomenon has been termed “hostile attributional bias” (Dodge 1980) to denote the aggressive child’s interpreting difficulty, though more recently the term “hostile attributional style” (HAS; e.g., Dodge 2006) has been used.

Individual differences in children’s social cognitive development suggest that some children do not develop the cognitive skills to correctly interpret others’ intentions until later childhood and adolescence (Petit and Mize 2007). Adolescents’ use of their evaluative skills appears to become especially important in the later stages of the SIP model (e.g., see Lansford et al. 2006). As such, there has been increased empirical study of the fifth step of SIP, *response decision* (see Fontaine et al. 2002; Fontaine and Dodge 2006; Fontaine et al. 2008; Fontaine et al. 2009). The importance of this set of processes is so significant that Fontaine and Dodge (2006) offered an advanced model of this SIP step, called *response evaluation and decision* (RED), articulating a wide array of evaluative judgment operations that are potentially active during youths’ response decision making.

During RED, an individual may consider several alternative behavioral responses based on multiple domains of evaluative judgment, including a) *response efficacy*: the individual's estimation of how likely he or she will be successful if the considered response were to be carried out, b) *response valuation*: the assignment of value to the response option in terms of its social and moral qualities, c) *outcome expectancy*: the estimation of the likelihood that the considered response will lead to a certain outcome, and d) *outcome valuation*: the process by which the individual assigns the likely outcome of the response some degree of positive or negative value. Finally, Fontaine and Dodge (2006) hypothesized that alternative responses are compared (*response comparison*) before the most appropriate response is selected (*response selection*; also, see Fontaine et al. 2008, 2009).

Fontaine and Dodge (2006) outlined various types of outcome expectancy in their model. For example, whereas emotional outcome expectancy refers to a person's estimation of how he or she will feel if a response is enacted, social outcome expectancy has to do with one's prediction of how others may view him or her if the behavior is performed. It is hypothesized that numerous types of outcome expectancy are potentially activated during this stage of processing, particularly in certain kinds of scenarios, such as challenge situations in which a person is unsure as to how to respond.

Whereas there has been impressive empirical evidence that RED processing is correlated with antisocial behavior during adolescence (e.g., see Fontaine et al. 2008), there has also been an increasing level of interest in examining when the cognitive skills necessary for RED processing develop. Following the idea that the early stages of SIP are evident in childhood and that RED processing appears to be prominent in adolescence (Fontaine et al. 2002), Fontaine and his colleagues (2009) tested whether the link between children's RED and antisocial behavior becomes stronger as they enter and continue through adolescence. Specifically, the researchers were interested in whether RED becomes more internally consistent, sophisticated (in terms of number of alternative processes involved), and related to antisocial behavior across childhood and adolescence.

In the Fontaine et al. (2009) study, which was conducted as part of the same longitudinal project (the Child Development Project; see below for a description) as the one herein reported, the researchers observed 585 participants from kindergarten to Grade 3 (Study 1) and later from Grade 8 to Grade 11 (Study 2). The participants were asked to respond to hypothetical vignettes presented as part of a RED assessment and completed multiple measures of antisocial behavior. Results indicated that although children were able to differentiate and consistently evaluate alternative responses by Grade 3, there was no consistent pattern of children's RED processing in relation to their conduct problem behaviors. The second study, however, revealed a strong link between RED and antisocial behavior during the adolescent years, suggesting not only that RED emerges by adolescence but that the role of this later set of SIP operations may be particularly important to understanding adolescent antisocial development.

Does RED Mediate the Relation between HAS and Antisocial Conduct in Adolescence?

An important question remains though, as to the relation of HAS and RED with respect to the development of antisocial behavior in adolescence. To date, no study has rigorously explored this relation, despite considerable research that supports the general SIP hypothesis that these (and other) social cognitive processes play critical roles in antisocial behavioral change across time. The question that guided the current study is whether RED is so important a set of processes by the time youths are developing through adolescence, and making considerable gains in executive function (Pettit and Mize 2007), that behavioral

decision-making processes better account for individual differences in adolescents' antisocial conduct.

Some earlier studies that examined the relation between attributional and response evaluation processes in children would suggest that these two SIP components play unique roles and together have an additive effect, as opposed to a mediational relation. For example, Dodge et al. (1986) conducted a pair of studies that examined the relations between children's social-information processing patterns and their interpersonal behavior in non-clinical and clinical samples. In both studies, they found that the interpretation and evaluation steps of SIP provided unique, incremental contributions toward the prediction of children's social conduct.

In an early investigation of the Child Development Project (the longitudinal project from which the current study stems; see below for details), Weiss et al. (1992) examined the mediational role of SIP on the relation between early harsh discipline and subsequent aggression and internalizing problems. They found that children's attributional and evaluation processes were not correlated at the bivariate level. Similar to the Dodge et al. (1986) studies, Weiss and his colleagues observed that the interpretation and evaluation steps of SIP contributed separately to the potential mediating role of children's social cognitive processing.

The Dodge et al. (1986) and Weiss et al. (1992) studies assessed SIP in childhood, though, not in adolescence. Certainly, the types of processes that are encompassed by RED (i.e., executive function operations such as evaluative judgment and decision making) change considerably from childhood to adolescence, and the Fontaine et al. (2009) studies, in particular, points to how much stronger the role of RED becomes as youths develop and approach adulthood. This difference is critical, and an understanding of it indicates that an alternative role of RED in the relation between youths' attributional processing and social behavior in adolescence be considered.

One possibility is that RED mediates the relation between HAS and antisocial behavior in adolescence. It may be that, by adolescence, youths' ability to evaluate responses across distinct domains may be sufficiently developed that this step of SIP plays a more powerful and proximate role in the enactment of antisocial conduct (see Fontaine et al. 2009). The antisocial adolescent may well have established an attributional style of processing that promotes hostile interpretations of others, but such processing may lead to various endorsements of aggressive responsivity that, in mediational turn, affect his or her antisocial outputs.

In What Other Ways May the RED Mediational Model Be Important?

In addition to incrementing and clarifying previous related studies, and adding to the scientific knowledge base, we believe that the RED mediational model presented herein may be applied and especially important to a number of real-world contexts. First, better understanding the sequence by which youths may enact antisocial behaviors in response to social stimuli is paramount to social-cognitive and behavioral intervention. Cognitive-behavioral intervention programs, such as the Coping Power Program (Lochman et al. 2008; Wells et al. 2008), have demonstrated considerable success by focusing on key components of social competence and self-regulation in youths as they learn in natural, developmental contexts. Achieving success in the domains of social competence and self-regulation requires that children develop social-cognitive skill sets by which they can both properly interpret and understand their social worlds and thoughtfully decide how to respond to social stimuli so that they behave in ways that promote social adaptation. The child who is biased toward hostile interpretation of ambiguous social cues may not only benefit from

considering alternative understandings but from evaluating his or her response options in ways that favor socially acceptable conduct, particularly in cases in which negative social interpretations call for relatively favorable evaluations of aggressive retaliation. The current study is the first to examine the degree to which this hypothesized sequence is empirically supported.

Second, research on social cognition and aggression has increasingly been the focus of interdisciplinary scholars who draw from developmental science to inform empirical questions that are relevant to juvenile justice (Fontaine 2008c; Graham and Halliday 2000; Steinberg and Scott 2003). One argument is that because adolescents' decision making capacity is underdeveloped as compared to adults, the former should not be punished to the same degree as are adults for the same criminal conduct. Of course, this argument is naturally limited if the processes by which adolescents make decisions to engage in antisocial conduct are only partially understood. The RED meditational model presented herein challenges the idea that adolescents' antisocial conduct is merely a product of attributing harmful intent to others and suggests that said conduct may result from a more cognitively involved sequence. This challenge goes to the question of how rationally based adolescent antisocial conduct is, an issue that is critical to determinations of culpability and punishment, as well as aspects of rehabilitation, including psycho-education, anger management, and social skills training (Fontaine 2008c).

Hypotheses

In the present investigation, we hypothesized that HAS, RED, and antisocial behavior are related at the bivariate level in adolescence, an expectation that was guided by past studies demonstrating such relations (e.g., Fontaine et al. 2002; Halligan et al. 2007). In addition, we examined whether RED increments the predictive utility of HAS in accounting for individual differences in antisocial behavior in adolescence. Finally, based on the RED findings generated by the Fontaine et al. (2009) pair of studies, as well as other investigations (e.g., Fontaine et al. 2002), we investigated the hypothesis that RED mediates the relation between HAS and subsequent antisocial behavior, controlling for antecedent antisocial conduct.

Methods

Participants

The Child Development Project (CDP; see Dodge et al. 1990; Dodge et al. 2003; Pettit et al. 1997; Fontaine et al. 2009) is a longitudinal investigation of the development of psychological and behavioral problems in youth. In the CDP, two cohorts of children entering kindergarten and their families from three geographic regions—Bloomington, Indiana, and Knoxville and Nashville, Tennessee—were recruited to participate in April of 1987 and 1988. Recruited children were randomly selected at preregistration for kindergarten. As approximately 15% of the children at targeted schools did not preregister, a matched percentage of the sample was instead recruited by mail or telephone. Approximately 75% of those recruited agreed to participate in the CDP. In the first year (kindergarten) of the study, the CDP consisted of 585 children (48% female; 81% Caucasian; 17% African American; 2% minority from other ethnic backgrounds), each of whom came from a separate family. Families' socioeconomic status was assessed via the Hollingshead (1979) index, which demonstrated a range from 11 to 66 with a mean in the low-middle class range ($M=39.59$, $SD=13.96$).

The present study focused on participants as they developed from middle to late adolescence, including Grades 10 (Age 15), 11, (16), and 12 (17). The retained sample at

each grade was 410 (70% of the original sample), 449 (77%), and 430 (74%), respectively, based on completion of at least one antisocial conduct assessment. Using structural equation modeling, missing scores were imputed such that all 585 of the original participants were included in the mediational analysis. No significant differences were found in patterns of correlations of key psychosocial variables between retained and attrited groups.

Antisocial Behavior

The Child Behavior Checklist (CBCL; as reported by mothers) and Youth Self-Report measures of externalizing problems (YSR) were administered in Grades 10 and 12 (Times 1 and 3, respectively), or ages 15 and 17, respectively (Achenbach 1991a, b, c). These measures have been found to have excellent reliability and high convergent, discriminant, and predictive validity (Wells 1995). The antisocial construct at Grades 10 and 12 were measured by taking the sums of the subscale scores (*Aggressive* and *Delinquent* problems). The reliability scores of Grades 10 and 12 antisocial behavior constructs were $\alpha=0.74$ and $\alpha=.73$, respectively.

Social Information Processing Protocol

In Grade 11 (age 16; Time 2), the social information processing (SIP) protocol was administered. Participants were shown six video-recorded vignettes representing ambiguous provocation situations. The social scenarios were selected based on adolescent focus groups, the results of which suggested that the depicted interactions are typical of everyday teenage life. Each vignette consisted of multiple segments and participants were asked to imagine themselves as the individual presented with, and responding to, an ambiguous provocation. In the first segment, the responding individual was presented with an ambiguous provocation stimulus. For example, in one vignette, participants imagined themselves finding an apparently abandoned backpack in their school's hallway and picking it up to inspect it. After picking up the backpack, the ambiguous provocateur approaches and neutrally informs: "That's my backpack." For the second segment of each vignette, participants were asked to imagine themselves as the individual responding in an aggressive fashion toward the ambiguous provocateur. To continue with the backpack example, participants were asked to imagine themselves angrily replying "Look, I didn't know whose it was. I was just looking at it, okay?!!!" Questions designed to reflect HAS and RED processes were asked of participants after the first and second segments, respectively. This SIP video vignette protocol and assessment was designed specifically for the CDP and has been utilized successfully in several other investigations (e.g., Crozier et al. 2008; Fontaine et al. 2008, 2009).

Hostile Attributional Style (HAS)—After the first segment of each of the six video vignettes, participants answered questions that were designed to represent the *interpretation of cues* step of SIP. The questions were presented on the video monitor as well as read aloud by an interviewer. The questions were also provided to the participants on a paper handout and asked to circle their answers according to scales that were individually tailored to the questions. Questions representing HAS were asked to assess attributions of blame and intent, including (scoring provided in parentheses): a) *Who, if anybody, is to blame for what happened?* i. *You* (1), ii. *The other person* (3), iii. *Both of you* (2), or iv. *Neither of you* (2); and b) *Was the other person:* i. *Trying to be mean?* (3), ii. *Kind of in-between?* (2), or iii. *Not trying to be mean?* (1). The scores from these questions were re-coded such that each represented a scale of one to three, by which a score of 1 = benign interpretation, 2 = neutral interpretation, and 3 = hostile interpretation ($\alpha=0.65$). This aggregate score was used as an indicator of HAS in the final structural equation model.

In addition to the video protocol, a second instrument was administered to assess participants' HAS. This instrument involved presenting adolescent participants with six stories that represented ambiguous provocation scenarios. The stories, and HAS questions that followed, were read aloud by an interviewer, as well as provided on a paper handout. For instance, one of the adolescent stories read: "Imagine that you are sitting at your desk at school before class starts and another kid runs down the aisle past your desk. Your books get knocked off the desk onto the floor, making a mess." Following the presentation of each story, participants were asked questions about the ambiguous provocation that were designed to assess HAS. For example, questions pertaining to attributions of hostile versus benign intent were asked following the "knocked over books" story: a) *How likely is it that the other kid knocked over your books on purpose to be mean to you?*; and b) *How likely is it that the other kid did not see your books and knocked them over by accident?* Participants responded according to a five-point continuous scale from *Not at all likely* (1) to *Very likely* (5). As with the video vignette instrument, participants scores were aggregated across all six stories ($\alpha=0.60$). This summed score was used as a second indicator of HAS in the final structural equation model.

This SIP written stories protocol and assessment was also designed for the CDP. This is the first investigation to use it to measure HAS. The combined reliability of all HAS items, across both video vignette and written stories assessments, was $\alpha=0.72$.

Response Evaluation and Decision (RED)—Following the second segment of each vignette, in which participants were asked to imagine themselves responding aggressively toward the ambiguous provocateur, questions designed to represent RED domains were administered: a) *How likely would it be that you would act this way?* ("internal congruence"; answers ranged across a five-point scale from *Not at all likely* [1] to *Very likely* [5]), b) *How good or bad do you think this is, as a way to act?* ("response valuation"; answers ranged from *Very bad* to *Very good*), c) *How easy would it be for you to act like this?* ("response efficacy"; answers ranged from *Very hard* to *Very easy*), d) *How would you feel about yourself if you acted like this?* ("emotional outcome expectancy"; answers ranged from *Very good* to *Very bad*), and e) *How much would other people like you if they saw you acting like this?* ("social outcome expectancy" answers ranged from *Not at all* to *Very much*). A sixth question that was individually tailored to each vignette to assess participants' instrumental outcome expectancy has been excluded from CDP studies due to the item's low internal consistency (e.g., see Fontaine et al. 2008, 2009). Participants' response scores were aggregated across all video vignettes within RED domain, resulting in five aggregate RED scores. Each RED domain aggregate score was used as an indicator of the RED construct in the one for each domain assessed and retained for CDP studies ($\alpha<0.80$ for each RED domain; overall RED $\alpha=0.92$).

Data Analytic Approach

Analyses of the present study included two steps. First, confirmatory factor analyses of the antisocial behavior (Grades 10 and 12; Times 1 and 3) and social information processing (HAS and RED: Grade 11; Time 2) constructs were conducted; sums of the subscales of each construct were used as the indicators, and SES, sex, and ethnicity were included as covariates of the target constructs. Ethnicity was dummy-coded into two variables (Caucasian/African American and Caucasian/other ethnicity). Measurement invariance of the antisocial behavior constructs across time was tested by comparing a baseline model with another model that had equality constraints imposed on the factor loadings of the antisocial constructs.

Second, structural equation models were estimated to examine the mediating effects of HAS and RED, accounting for the effects of SES, sex, and ethnicity on both the mediators and antisocial construct at Time 3. A structural equation model without the effect of RED on antisocial behavior at Time 3 was first estimated to examine the effect of HAS on subsequent antisocial behavior. Next, a model with the effect of RED on antisocial behavior at Time 3 was included to examine the mediating effect of RED on the relation between HAS and subsequent antisocial conduct.

Statistically significant parameters were reported together with their 95% confidence intervals (CI) in parentheses. The latent variable program *Mplus* (v.5.1; Muthén and Muthén 1998–2008) was used for these analyses. Missing values for the sample information were dealt with using maximum likelihood estimation in *Mplus*, and SES, sex, and ethnicity served as auxiliary variables (Collins et al. 2002).

Note that we identified Grade 10 antisocial behavior as the more appropriate covariate to Grade 11 antisocial behavior. SIP theory hypothesizes that cognitive processing fully mediates environmental effects on human social behavior and that processing is proximate to subsequent behavioral outputs. As such, one would conceptualize Grade 11 behaviors as proximate results of Grade 11 processing. Furthermore, because processing and behavior are hypothesized to transact with each other in a continuous fashion (see Fontaine and Dodge 2009; Fontaine et al. 2008), it is likely that controlling for Grade 11 antisocial behavior would inappropriately mask the chain from Grade 11 SIP to Grade 12 antisocial behavior.

Results

The sample correlation matrix and means for all the items included in the confirmatory factor analyses and structural equation modeling are presented in Table 1.

Confirmatory factor analysis, which was conducted to test measurement properties of the target constructs, demonstrated that the constructs were adequately measured and that their levels varied with the covariates. The baseline model for comparing parameters fit the data satisfactorily with $\chi^2(113, n=585)=276.63, p<0.01, CFI=0.96, TLI=0.94, RMSEA=0.05$, and SRMR=0.05. The model with the equality constraints on the factor loadings of antisocial behavior constructs across time fit the data satisfactorily, with $\chi^2(116, n=585)=277.55, p<0.01, CFI=0.96, TLI=0.94, RMSEA=0.05$, and SRMR=0.05. The nonsignificant Chi-square difference between these two models suggested that the antisocial behavior constructs were measured equivalently over time ($\chi^2_{dif}=0.92, df_{dif}=3, p>0.05$). The standardized factor loadings and covariate effects are listed in Table 2.

The significant covariate effects suggest that female respondents had lower means of HAS ($\gamma=-0.32, p<0.05, CI=-0.43\sim-0.21$) and RED ($\gamma=-0.23, p<0.05, CI=-0.33\sim-0.14$) than did their male peers. Caucasian respondents had a lower mean of HAS ($\gamma=-0.15, p<0.05, CI=-0.30\sim-0.01$) than did their African American counterparts. In addition, SES was negatively associated with antisocial behavior at Time 1 ($\gamma=-0.15, p<0.05, -0.26\sim-0.03$).

Results of structural equation modeling showed support for the hypotheses of this study. The first structural equation model—that is, the direct-effect model, excluding the effect of RED on Time 3 antisocial behavior—found that HAS had a significant effect on Time 3 antisocial behavior, controlling for Time 1 antisocial problems ($\beta=0.13, p<0.05, CI=0.00\sim0.26$). This model fit the data well with $\chi^2(116, n=585)=277.55, p<0.01, CFI=0.96, TLI=0.94, RMSEA=0.05$, and SRMR=0.05.

The final structural equation model—that is, the mediational model including the effect of RED on Time 3 antisocial conduct—fit the data equivalently well, with $\chi^2(116,$

$n=585$)=277.55, $p<0.01$, CFI=0.96, TLI=0.94, RMSEA=0.05, SRMR=0.05. Parameter estimates of the final model are depicted in Fig. 1.

Time 1 antisocial behavior predicted HAS ($\beta_1=0.20$, $p<0.01$, CI=0.06~0.34) and RED ($\beta_3=0.29$, $p<0.01$, CI=0.19~0.40) at Time 2, and antisocial problems at Time 3 ($\beta_2=0.76$, $p<0.01$, CI=0.67~0.86). With RED included the model, HAS was found to have no effect subsequent antisocial behavior ($\beta_5=0.02$, $p>0.05$, CI=-0.15~0.19), but an effect on RED ($\beta_4=0.57$, $p<0.01$, CI=0.45~0.69). RED had a significant effect on antisocial behavior at Time 3 ($\beta_6=0.19$, $p<0.01$, CI=0.03~0.35) and a significant mediating effect on the relation between HAS and Time 3 antisocial behavior ($\Delta\beta=0.11$, $p<0.05$, CI=0.03~0.20). The mediating effect was based on the test of the product of b_4 and b_6 (0.11) in the *Mplus* program. This was equivalent to the traditional test of the decrease of b_5 (the direct effect of HAS on Time 3 antisocial conduct) upon the inclusion of path b_6 . In the same fashion, RED was found to have an additional mediating effect on the relation between Time 1 and Time 3 antisocial behavior ($\Delta b=0.06$, $p<0.05$, CI=0.01~0.12)."

Discussion

Numerous studies have examined the relation between hostile attributional style—or, the tendency to attribute meanness and hostile intent to stimulus actors in ambiguous provocation situations—and antisocial behavior in youth (Orobio de Castro et al. 2002). However, relatively few of these studies have examined this relation in adolescence. Indeed none have examined how evaluative behavioral judgment and response decision making impacts the effect of hostile attribution on aggressive and delinquent conduct in this developmental period. The present study tested the intervening role of later social information processing (SIP) on early SIP operations by specifically testing the mediating effect of response evaluation and decision (RED) on the relation between hostile attributional style (HAS) and subsequent antisocial behavior, controlling for antecedent externalizing conduct problems.

Results supported all hypotheses. Antisocial behavior (Times 1 and 3), HAS (Time 2), and aggressive RED (Time 2) were all positively correlated at the bivariate level. HAS significantly predicted antisocial behavior at Time 3, controlling for antisocial conduct at Time 1. However, this direct effect was mediated by aggressive RED. The effect of HAS on subsequent antisocial behavior was significantly reduced and became non-significant when the intervening influence of RED was introduced. In addition, RED significantly incremented the effects of prior antisocial conduct and HAS on subsequent antisocial behavior, and partially mediated the developmental change in antisocial behavior from Time 1 to Time 3.

Although findings indicate full statistical mediation, the remaining effect of HAS on adolescents' antisocial behavior approached statistical significance. We mention this so that present findings may be balanced with those of past studies, such as Dodge et al. (1986) and Weiss et al. (1992), which have found that attributional and evaluation steps of SIP provide unique increments in the prediction of youths' antisocial conduct. However, these earlier studies were examinations of child processes, so the difference in results is understandable in light of research that has shown the executive function skills develop significantly in adolescence (e.g., see Keating 2004, and Steinberg 2005, for recent reviews), and, more importantly, research on the development of RED that has found that adolescents' response judgments and decision making are far more sophisticated in adolescence as compared to childhood. Nevertheless, present findings suggest that RED may not entirely account for the influence of HAS; rather, an interpretation that RED only partially mediates the effect of HAS on adolescent antisocial behavior may be more accurate.

Findings suggest that, although aggressive adolescents tend to attribute hostile intent to stimulus actors in ambiguous provocation situations, there is more to their social cognitive story. Our mediational test points to a social cognition-behavior sequence by which adolescents attribute hostile intent and then assess aggressive response options as a favorable course of action across a number of evaluative domains. Aggressive adolescents appear to identify positively with aggressive behavior (internal congruence), judge aggression as a sociomorally acceptable response strategy (response valuation), have confidence that they can successfully perform aggression (response efficacy), and expect both positive emotions (emotional outcome expectancy) and social acceptance (social outcome expectancy) to result from responding aggressively, when presented with ambiguous provocation situations. This set of RED processes was found to mediate early SIP processes in the development of antisocial behavioral change in adolescence.

Results of this study point to the need to investigate more advanced social-cognitive processes in the enactment and maintenance of antisocial behavior in adolescence. As mentioned, findings are consistent with research on executive function during this developmental period that has shown that youths make considerable gains in evaluative decision making as they enter adolescence and develop toward adulthood (e.g., Cobb 1992; Keating 1980, 2004; Steinberg 2005). By late adolescence, youths have developed the ability to evaluate alternative social behaviors across empirically distinct domains (Fontaine et al. 2002; Fontaine et al. 2009) and this set of skills allows for variations in processing sequences that are not only important to understanding adolescent development, but may be crucial to understand if interventions with aggressive adolescents are to be successful.

Limitations

We should recognize some limitations of the present study. First, although an alternative approach may assess all target variables at separate time points, we measured HAS and RED simultaneously at Time 2 as part of the SIP protocol. This decision was made, in part, because SIP was not assessed every year in the CDP. Whereas the methodology employed may not be perfect for the mediational model we tested, it is sensible in light of SIP theory. SIP posits that, based to some degree on one's understanding or interpretation of presented social cues and his or her social world, a person evaluates behavioral responses across different domains so that he or she can decide how to respond to a social stimulus. Thus these respective cognitions—interpretation/attribution and RED—naturally unfold in close temporal proximity to each other. The methodology herein employed was designed to both (a) capture these empirically discernible sets of cognitive processes, and (b) assess them in the temporally-correct sequence that matches the SIP rationale. Although HAS and RED were assessed within the same measure, HAS (segment 1) was assessed prior to RED (segment 2) for each video vignette. In this way, HAS was consistently assessed prior to RED, providing the temporal order that matches the tested mediational model.

Furthermore, our interpretation of the results is consistent with a conceptual model of SIP and antisocial behavior that views social cognitive processing and behavior as dynamically related in real-time on a continual basis. That is, we would hypothesize that the mediation of the effect of HAS on antisocial behavior does indeed take place so quickly that measuring SIP components, such as HAS and RED, at distinctly separate time points actually does not favor a test of the mediational hypothesis that guided the present investigation. Grade 11 (Time 2) antisocial behavior could have been entered as our dependent variable as we would expect Grade 11 SIP to affect Grade 11 antisocial conduct. However, we chose to examine Grade 12 antisocial behavior because we were interested in examining the effect of HAS and RED on developmental change of antisocial enactments across time.

Second, the effect of RED may have been even more robust if a more recent, comprehensive model had been tested. The model tested was based on an earlier conceptualization of the response decision step of SIP articulated by Crick and Dodge (1994). The far more sophisticated model recently offered by Fontaine and Dodge (2006) proposes numerous additional social cognitive mechanisms that may play a role in the incremental and mediational effects of RED in the development of adolescent antisocial behavior.

Third, the research design utilized was of a correlational nature, limiting our ability to draw causal conclusions from the results. Of course, the issue of causality is naturally problematic when testing mediational models because it is impossible to simultaneously manipulate the independent and mediating variables. Still, a manipulation of hostile attributions may be possible in future studies (though doing so does not directly address the individual differences question of interest in the present study). Certainly, both types of empirical investigation play important roles in understanding developmental mechanisms in antisocial behavior.

It should also be recognized that alternative interpretations of the present findings are possible. One such alternative interpretation is that our measurement of RED is not so much an assessment of on-line processing as it is of latent cognitive structures, such as schemata that generally endorse aggressive behavioral strategies. Some social cognitive models of aggressive behavior, such as the social-cognitive information processing model offered by Huesmann (1988, 1998) emphasizes these mechanisms in the automatic processing of aggressive behavioral outputs. Since we did not measure both on-line RED and aggressive behavioral scripts in this study, it is not possible to know. However, our paradigm was designed to assess aggressive-response evaluations in the context of hypothetical ongoing social interactions, not stable beliefs about the acceptability of aggressive behavior. In addition, some studies have distinguished on-line from off-line cognitive factors in the development of aggression, and it does appear that the two play empirically separate roles (e.g., Dodge et al. 2002; Zelli et al. 1999).

Due the simultaneous assessment of HAS and RED at Time 2, and the correlational nature of the study, we are not able to rule out the possibility that HAS mediates the effect of RED on antisocial behavior. In particular, to the degree that assessments of RED may reflect stable beliefs that favor aggressive behavior, evaluations of aggressive response options may lead to hostile attributions of ambiguous provocateurs, in turn impacting one's propensity to behave in an antisocial manner. Although this possibility is not directly suggested from our working theory, it is a possibility that should be recognized nonetheless.

A related issue has to do with participants' ability to, and interest in, imagining themselves as the third-party characters displayed in the video-recorded stories. Of course, some participants were likely more capable and mentally invested in the task than others. Because the paradigm asks participants to project themselves into the hypothetical interactions, some participants' responses may more accurately reflect their assessments of *others'* behaviors than of their own.

Future Directions

Findings of this study point to some future directions for basic and clinical intervention research. First, future studies of evaluative judgment and behavioral decision making should attend to the processes outlined by Fontaine and Dodge (2006) in their reformulation of RED. In addition, Fontaine (2006, 2007b, 2008a) has discussed evaluative decision making processing that may be activated in the course of antisocial planning and instrumental aggressive behavior. This body of theoretical work ties findings from several fields and sub-

fields of psychology together such that a more comprehensive model of youths' social decision making may be understood and empirically tested.

Second, the mediational sequence that was tested in the present study should be examined by antisocial subtype (for a recent review, see Fontaine 2007a). Whereas instrumental (or proactive) aggression is typified by self-initiated antisocial conduct that is enacted in a relatively less-aroused state for the purpose of personal gain, reactive aggression is characterized by emotional violence that is enacted to hurt or defend in response to a perceived provocateur or threat. The mediational test in this sequence may work equally with both subtypes, but there is reason to believe that it may be even stronger if tested with a reactive aggressive sample of youths. The reason underlying this suggestion is that hostile attributional bias has been shown to be uniquely strong among reactive (as opposed to instrumental or proactive) aggressive youths (for reviews of the empirical literature on reactive aggression, see, Fontaine 2007a, 2008b, 2009).

Third, future studies should include assessments of both on-line RED processing and latent cognitive structures such as aggressive behavioral scripts. Studies that include measures of both sets of cognitive factors may be able to rule out alternative interpretations of the present study, as discussed earlier. In addition, such research may be helpful to designing more effective clinical interventions with antisocial youths. It may be that aggressive adolescents would be better served by interventions that both address their stable beliefs about the acceptability of antisocial forms of behavior as well as how they process social information in challenging response situations.

Conclusion

The present study is the first to focus on and test the mediating role of response decision making in the well-established relation between hostile attributional style and antisocial behavior in adolescence. Our findings suggest that, by adolescence, youths' evaluative judgment and behavioral decision making skills are sufficiently developed that the cognitive processing that is activated in response to challenging social cues is more complex than previously considered. That is, adolescents' responsive cognitive processing appears to involve more than mere snap judgments of others' condemnation (attributions of hostile intent) when presented with ambiguous provocation cues. Rather, antisocial adolescents appear to evaluate aggressive behavioral responses favorably across multiple qualitatively-distinct domains, a step of processing that is more powerful in their ultimate enactments of aggressive and delinquent conduct than that of making intent and blame attributions. Findings suggest future directions for basic and clinical intervention science, which are herein discussed.

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Standardized indirect effect ($\Delta\beta$): $0.13 - 0.02 = \beta_4 \times \beta_6 \approx 0.11$ (11%); $z = 2.25, p < 0.05$

Fig. 1.

Mediation of relation between hostile attributional style and antisocial behavior by intervening response evaluation and decision (RED)

Table 1

Correlation Matrix and Means (bottom row) Construct Subdimensions

	Grade 10				Grade 11				Grade 12				Covariates						
	DELC	AGGC	DELY	AGGY	HASV	HASS	IC	RV	RE	EOE	SOE	DELC	AGGC	DELY	AGGY	SEX	SES	RACE1	RACE2
DELC	1.00																		
AGGC	0.68	1.00																	
DELY	0.48	0.29	1.00																
AGGY	0.38	0.48	0.59	1.00															
HASV	-0.01	0.02	0.04	0.09	1.00														
HASS	0.11	0.12	0.17	0.19	0.44	1.00													
IC	0.22	0.31	0.19	0.37	0.45	0.40	1.00												
RV	0.15	0.17	0.24	0.32	0.38	0.36	0.75	1.00											
RE	0.24	0.25	0.27	0.38	0.32	0.34	0.74	0.70	1.00										
EOE	0.19	0.19	0.27	0.31	0.40	0.38	0.72	0.81	0.74	1.00									
SOE	0.11	0.17	0.18	0.26	0.37	0.34	0.64	0.65	0.65	0.68	1.00								
DELC	0.51	0.52	0.35	0.30	-0.01	0.17	0.21	0.17	0.25	0.24	0.10	1.00							
AGGC	0.41	0.70	0.24	0.40	-0.02	0.17	0.25	0.16	0.26	0.18	0.14	0.72	1.00						
DELY	0.33	0.24	0.58	0.47	0.19	0.22	0.29	0.32	0.41	0.41	0.23	0.46	0.29	1.00					
AGGY	0.26	0.37	0.44	0.71	0.13	0.16	0.35	0.32	0.43	0.34	0.24	0.35	0.40	0.65	1.00				
SEX	0.01	-0.01	0.04	0.00	-0.28	-0.13	-0.15	-0.18	-0.19	-0.25	-0.08	-0.02	0.01	-0.10	-0.05	1.00			
SES	-0.16	-0.24	-0.04	-0.08	0.09	-0.09	-0.17	-0.09	-0.12	-0.18	-0.16	-0.13	-0.16	0.00	-0.01	-0.05	1.00		
RACE1	0.05	0.10	0.00	-0.04	-0.18	0.10	0.08	0.03	0.07	0.12	0.17	0.03	0.13	-0.06	-0.07	0.03	-0.40	1.00	
RACE2	0.00	0.01	-0.01	0.01	0.01	-0.01	0.00	-0.06	0.01	-0.06	-0.08	-0.02	-0.01	-0.01	-0.03	-0.03	-0.01	-0.06	1.00
Mean	1.98	6.20	3.51	7.78	13.39	14.73	9.27	9.83	12.06	11.20	9.81	2.12	5.13	3.36	6.41	0.48	39.62	0.17	0.02

DEL Delinquency (CBCL); AGG Aggression (CBCL); DEL Delinquency (YSR); AGG Aggression (YSR); HAS Hostile attributional style (Videos); HAS Hostile attributional style (Stories); IC Internal congruence; RV Response valuation; RE Response efficacy; EOE Emotional outcome expectancy; SOE Social outcome expectancy; RACE1 Caucasian/African American; RACE2 Caucasian/other ethnicity.

Table 2

Covariate Effects on Constructs and Standardized Factor Loadings of Indicators

Covariate	Effect (95% C.I.)	Construct	Item contents	Standardized factor loading (95% C.I.)
Sex	-0.23* (-0.33~-0.14)	RED	CIC	0.88 (0.85~0.91)
SES	-0.17* (-0.28~-0.07)		CRV	0.87 (0.84~0.89)
Cauc. Vs. Af.Am.	0.04 (-0.08~0.16)			
Cauc. Vs. Other	-0.04 (-0.17~0.08)			
			CRE	0.83 (0.79~0.86)
			CEOE	0.92 (0.89~0.94)
			CSOE	0.75 (0.70~0.80)
Sex	-0.32* (-0.43~-0.21)	HAS		
SES	-0.02 (-0.15~0.11)		CHABV	0.80 (0.70~0.91)
Cauc. Vs. Af.Am.	-0.15* (-0.30~-0.01)		CHABS	0.56 (0.46~0.66)
Cauc. Vs. Other	-0.00 (-0.16~0.15)			
Sex	0.01 (-0.09~0.11)	Antisocial behavior (Grade 10)	CBCL (Mother) Delinquency	0.55 (0.46~0.64)
SES	-0.15* (-0.26~-0.03)		CBCL (Mother) Aggression	0.55 (0.46~0.64)
Cauc. Vs. Af.Am.	-0.05 (-0.17~0.08)		YSR Delinquency	0.78 (0.71~0.86)
Cauc. Vs. Other	0.00 (-0.12~0.13)		YSR Aggression	0.80 (0.73~0.86)
Sex	-0.06 (-0.17~0.05)	Antisocial behavior (Grade 12)	CBCL (Mother) Delinquency	0.46 (0.37~0.56)
SES	-0.06 (-0.19~0.06)		CBCL (Mother) Aggression	0.49 (0.40~0.59)
Cauc. Vs. Af.Am.	-0.05 (-0.18~0.08)		YSR Delinquency	0.73 (0.63~0.83)
Cauc. Vs. Other	-0.03 (-0.17~0.10)		YSR Aggression	0.75 (0.66~0.83)

* indicates statistical significance level at <0.05;

Cauc. Caucasian; *Af.Am.* African American; *Other* Other ethnicity (non-Caucasian); *CBCL* Child behavior checklist; *YSR* Youth self-report; *RED* Response evaluation and decision; *HAS* Hostile attributional style.