

THE EFFECT OF ANALYTIC THINKING ON DELINQUENCY-RELATED FACTORS  
AND TREATMENT ENGAGEMENT AMONG ADOLESCENTS

by

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# **The Effect of Analytic Thinking on Delinquency-Related Factors and Treatment Engagement Among Adolescents**

Clinical approaches validated as effective for substance abusing adolescents produce desirable outcomes for a significant proportion of treatment participants (Tanner-Smith, Jo Wilson, 2013); however, they are not universally efficacious. Treatment-seekers with a history of delinquency-linked problem behaviors respond less positively to treatment than non-delinquent adolescents (Dobkin, Tremblay, Masse, & Vitaro, 1995; Godley, Godley, Funk, Dennis, & Loveland, 2001; O’Neill, Lidz, & Heilbrun, 2003). Delinquency-related factors place youth at risk for future problems (Dobkin et al., 1995; Fergusson & Woodward, 2000) and are barriers to treatment engagement and clinical improvement.

The purpose of this study is to provide additional information about delinquency-related factors and treatment engagement with the goal of identifying plausible intervention targets for at-risk youth. To that end, the study proposes and tests the explanatory utility of an integrated social-cognitive developmental model which incorporates basic components of information processing (IP) and dual-processing (DP) models. The following paragraphs introduce delinquency-related factors and describe their associations with treatment measures. Next, the IP and DP theories are described, followed by an overview of the proposed IP-DP integrated model and the expected associations between variables of interest. Finally, the model is tested using adolescent treatment participant data from the Texas Christian University Adolescent Project, and the results are discussed in terms of their relevance for future exploration.

### **Delinquency-Related Factors Affect Treatment and Are Interconnected**

Research indicates that treatment-referred teens with a history of comorbid substance abuse and problem behaviors benefit less from evidence-based practices than those without a similar history. Delinquency-related factors are associated with lower treatment response (Best, Day, Campbell, Flynn, & Simpson, 2009; Godley, Godley, Funk, Dennis, & Loveland, 2001; Grella, Hser, Joshi, & Rounds-Bryant, 2001; Wong, Hser, & Grella, 2002) and less clinical improvement (Grella et al., 2001; O'Neill, Lidz, & Heilbrun, 2003; Rowe, Liddle, Greenbaum, & Henderson, 2004), and thus comprise a sub-group of interrelated barriers. In this study, delinquency-related factors refer to externalizing behaviors (conduct disorder symptoms, criminal offending, and psychopathic characteristics), risk taking, impulsivity (especially negative urgency), and association with deviant peers.

### **Delinquency-Related Factors Negatively Affect Treatment**

Earlier studies from adult literature identified links between externalizing behaviors and reduced treatment response (McLellan et al., 1994; Tims et al., 1991). Similar patterns have since been observed for adolescents (Godley, Godley, Funk, Dennis, & Loveland, 2001; Grella, Hser, Joshi, & Rounds-Bryant, 2001; McLellan et al., 1994; O'Neill, Lidz, & Heilbrun, 2003; Tims, Fletcher, & Hubbard, 1991; Wong, Hser, & Grella, 2002). During treatment, comorbid participants (e.g., those with substance abuse and conduct disorder) are more likely to have more severe substance use diagnoses and to report more problems with family, friends, school, and criminal behavior (Grella et al., 2001). Comorbid participants are also more likely to use substances and engage in criminal behaviors a year after treatment. These youth also have more difficulty navigating through treatment. Participants with no remorse, high hostility, and conduct disorder are less likely to self-report treatment

compliance than their peers without those characteristics (Wong et al., 2002). Similarly, unplanned discharge is associated with reports of conduct disorder symptoms among young residential treatment participants (Godley et al., 2001). Furthermore, psychopathic characteristics (callousness, remorselessness, and chronic antisocial lifestyle) among juvenile-justice involved youth are associated with decreased abstinence, less treatment engagement, and less clinical improvement (O'Neill et al., 2003). Thus, delinquent youth tend to engage less in and respond less positively to treatment.

Of evidence-based practices for substance-abusing adolescents, family-based treatment approaches are especially effective (Tanner-Smith, Jo Wilson, 2013); however, externalizing behaviors (delinquency and aggression) negatively impact individual and family-based treatment outcomes (Rowe, Liddle, Greenbaum, & Henderson, 2004). Comparing family and individual treatment outcomes between participants with substance abuse only (SA), substance abuse with externalizing behaviors (SAE), and substance abuse with both externalizing and internalizing behaviors (SAEI), substance use improves for substance abuse only (SA) adolescents, but returns to intake levels for coexisting (SAEI) adolescents at twelve months post-treatment.

For adults, risk taking is also a treatment barrier. One study examining treatment engagement in substance-abusing adults in the United Kingdom indicated that risk taking is related to reduced overall treatment engagement. The authors also reported that hostility and risk taking are related to increased criminal thinking which is negatively associated with treatment engagement (Best, Day, Campbell, Flynn, & Simpson, 2009). Similar patterns may exist among adolescents.

## **Delinquency-Related Factors Are Interconnected**

In addition to their negative effects on treatment engagement and outcomes, delinquency-related factors are also associated with other psychosocial problems and with each other (Randall, Henggeler, Pickrel, & Brondino, 1999). For substance-abusing and dependent juvenile offenders on probationary status, externalizing disorders (conduct disorder, oppositional defiant disorder, or attention-deficit hyperactivity disorder) are associated with higher rates of antisocial behavior, criminal offending, substance use, association with deviant peers, and conformity to antisocial peer behavior. Moreover, baseline externalizing disorders predict increased rates of general delinquency and substance use sixteen months later. Likewise, other studies link earlier delinquency to later delinquency (Dobkin, Tremblay, Masse, & Vitaro, 1995), suggesting younger adolescents engaging in deviant behaviors tend to continue to do so as they get older. Additionally, for girls, conduct problems at age 13 are not only associated with continued conduct problems at age 18, but also criminal offending, substance use, and risk taking (Fergusson & Woodward, 2000).

Externalizing behaviors among youth are also related to increased involvement with deviant peers (Buehler, 2006). The reverse is additionally true; increased involvement with deviant peers is associated with more delinquency and substance use (Levine & Singer, 1988). Susceptibility to influence seems to play a role in these links (Prinstein, Brechwald, & Cohen, 2011). For youth identified as being highly susceptible to high-status (popular/well-liked) peers, baseline perceptions of youths' best friends' participation in deviant behaviors are associated with the youths' own increased engagement in deviant behaviors eighteen-months later.

Risk taking is also linked to negative peer relationships. Being more inclined to take risks predicts increased susceptibility to negative peer pressure for alcohol use (Henry, Slater, & Oetting, 2005). Interestingly, researchers also found that perception of harm of risk taking moderates the relationship between friend influence and alcohol use. Specifically, the effect of alcohol-using friends on an adolescent's own alcohol use is more robust when the adolescent is less likely to perceive alcohol use as harmful. This suggests that an adolescent's ability to identify future negative consequences might attenuate the effect of negative peer influences. Although more deliberative thinking may reduce the harmful influence of negative peers, it may also be the case that adolescents engaging less in this type of premeditation are also more likely to associate with deviant peers. Researchers suggest a possible indirect effect of thinking ahead on delinquent behaviors through its affiliation with deviant peers (Wolff & Crockett, 2011). Other peer-related links indicate that simply having peers present during task completion increases risky decision-making (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). Authors suggest that the presence of peers may increase the perceived reward value associated with taking risks.

Externalizing behaviors and risk taking are also directly associated. When asked to choose between high reward/high loss and low reward/low loss options, adolescents with a history of criminal behavior, substance use, and conduct disorder (high-risk) tended to choose high reward options more frequently than low-risk teens (Lane & Cherek, 2001). In addition, following only a single gain in the high reward option, high-risk teens persist in choosing the high reward option even after experiencing negative outcomes (loss).

To further compound the problem, externalizing problems and risk taking are related to various forms of impulsivity (Hope & Chapple, 2005; Khurana, Romer, Betancourt,

Brodsky, Giannetta, & Hurt, 2012; Pharo, Sim, Graham, Gross, & Hayne, 2011; Romer, Betancourt, Brodsky, Giannetta, Yang, & Hurt, 2011), and risk taking and impulsivity seem to be related neurologically (Pharo et al., 2011; Romer et al., 2011). Developmental neurological changes, along with individual variability in risk taking predisposition, may account for some adolescents' proneness to risk taking (Galvan, Hare, Voss, Glover, & Casey, 2007).

Negative urgency (a form of impulsivity characterized by rash behavior under the influence of negative emotions) is associated with increased substance use and substance-related problems and has significant effects on substance-related outcomes above and beyond other forms of impulsivity and self-regulation measures (Adams, Kaiser, Lynam, Charnigo, & Milich, 2012; Kaiser, Milich, Lynam, & Charnigo, 2012; Karyadi & King, 2011). There are also links between negative urgency and externalizing disorders among preadolescents, middle school students, and college students (Settles, Fischer, Cyders, Combs, Gunn, & Smith, 2012; Marmorstein, 2013). Higher negative urgency among college students is related to higher secondary psychopathy, which is characterized by destructive behaviors and impulsivity (Anestis, Anestis, & Joiner, 2009).

## **Summary**

Delinquency-related factors are associated with higher treatment attrition, less positive treatment response, lower compliance, and increased future criminal thinking and delinquency. In addition, components of delinquency are highly interconnected and are associated with other psychosocial problems. Despite their interrelatedness, the impact that each has on treatment may vary. Considering these points, the delinquency-related factors of interest in this study include externalizing behaviors (represented by hostility), risk taking,

negative urgency, and exposure to deviant peers/friends. Engagement factors of interest are treatment-peer support and treatment participation. Understanding these relationships for adolescents in treatment may help identify key intervention targets for delinquent youth.

### **Adolescent Cognitive Models May Explain Developmental Links**

The associations between delinquency-related factors and treatment engagement are perhaps best studied using established developmental social-cognitive models. Information processing models are structured, easily testable, and have been successfully applied to youth misbehavior. Dual-processing models propose cognitive dynamics that are contemporary, grounded in neurodevelopment literature, and complementary to IP steps. Integrating components from both models may provide a parsimonious explanation that is comprehensive enough to identify multiple intervention options and to make a significant contribution to the current knowledge base.

### **Information Processing Models Offer a Developmental Explanation of Aggression**

Information processing (IP) is a general term describing cognitive models that use an overarching data-in/data-out paradigm analogous to software programming. IP models are applied in various areas of psychology. The general IP cognitive model conceptualizes cognitive processing as occurring in linear steps (Siegel, Welsh, & Senna, 2006). When data (social information/cues) is perceived (data-in), it is encoded, then interpreted. The interpretation of these data is then used to make a decision which manifests as behavior. One of the more established and sophisticated IP models is the social information processing (SIP) model first proposed in 1986 by Kenneth Dodge, and reformulated nearly a decade later by Crick and Dodge (1994). The revised SIP model suggests that cognitive processing occurs in six steps during which judgments and decisions are refined via each step's

interaction with the contents of episodic memory. This feedback loop is thought to provide constant interplay and to account for individual variability in social cue response.

The first processing step in the revised SIP model suggests incoming data (external/social cues) is perceived and encoded using internal cues provided by the feedback loop. In step two, a mental representation of the perceived data is formulated and interpretation begins. In step three, the individual identifies the desired outcome of responding to the interpreted data. In other words, the individual develops a goal. Then the response options expected to result in the desired outcome are identified in step four. In step five, the response perceived to be the best fit is chosen from available options. This is followed by the behavioral manifestation of the chosen response in step six. All six steps are expected to occur for all individuals in any given situation. However, while the structure (the steps) is thought to occur universally, the contents of the episodic memory driving the feedback loop are thought to account for response variability. Thus, cognitive content (schemas or scripts), not external/social cues, influences behavior.

A common term for cognitive content in the literature is schema (for a brief overview, see Brooks & Dansereau, 1983). Schemas are thought to be combinations of simple cues that serve as frameworks for the interpretation and integration of similar and/or new cues. For example, when teaching a new concept to students, such as fractions, instructors may use analogies or refer to simpler constructs that students are expected to know, such as cooking. These simpler concepts are thought to be comprised of schemas established previously. *If the student wants to make twelve cookies, but the recipe makes twenty four, the student can cut the recipe in half.* A student may already understand these cues via a cooking schema, but by adding a new cue (*cutting the recipe in half is equivalent to multiplying the amount of*

*each ingredient by 1/2*) the schema is expanded to incorporate a more complicated construct. In addition to representing concepts, schemas can also represent a series of actions. When a student learns to perform mathematical procedures, he/she learns that a specific series of operations is necessary. These operations or actions are also stored as schemas and are commonly referred to as scripts.

In 1994, when the SIP model was reformulated, the authors offered an explanation of the development of aggression and problem behaviors (for a thorough explanation, see Crick & Dodge, 1994). They suggested that frequently exposing children to aggression and violence causes an overrepresentation of hostile and violent cues in schemas within the episodic memory. This overrepresentation then dominates the feedback loop affecting all processing steps by limiting variability in cue processing. Because aggressive/violent schemas are proportionally greater in these individuals than non-aggressive/non-violent schemas, cognitive processing becomes maladaptive. For example, youth with maladaptive scripts may be overly sensitive to, and therefore overly attend to aggressive social cues while ignoring non-aggressive social cues. These youth then interpret neutral social cues as aggressive (hostile attribution bias). Youth may also develop a positive attitude toward aggressive behaviors if they are perceived to produce desirable results. These maladaptations result in decisions and behaviors that are more likely to be aggressive or violent. The SIP developmental postulates have been repeatedly tested and supported in youth misbehavior and aggression studies (Dodge & Pettit, 2003).

If the SIP model and developmental explanation are valid, empirical tests should provide support for three assumptions. First, cognitive content should impact behavior. In this case, aggressive schema content should predict aggressive behavior. Burks, Laird,

Dodge, Pettit, and Bates (1999) provided evidence supporting this assumption. School-aged children interpreting neutral social cues as hostile or threatening are more likely to have problem behaviors such as fighting, threatening, and direct disobedience. They also found that the longitudinal relationship between kindergarten and eighth grade aggressive behavior is partially mediated by hostile knowledge structure (cognitive content). In other words, hostile knowledge structure accounts for problem behavior stability over time.

The second assumption states that there are distinctive steps in cognitive processing. In other words, the impact of aggression on different processing steps should predict behavior variation. Tests of SIP support this assumption. Earlier studies of problem behaviors in children demonstrated there are at least two distinct types of aggression (Dodge & Coie, 1987). Reactive aggression is characterized as behaving in a defensive manner in response to social cues perceived as aggressive or threatening. Proactive aggression is characterized as intentional and goal-oriented. Consistent with the second assumption, hostile attribution bias (assigning hostile intent to neutral social cues) is associated with reactive aggression, whereas having more positive attitudes about aggression is associated with proactive aggression (Crick & Dodge, 1996). These findings suggest that proactive-aggressive children prefer aggressive response options, and intentionally choose to behave aggressively to reach a goal. This is expected if the effect of aggressive schemas on cognitive processing is greater at later steps in the process (response-option steps). Results also suggest that reactive-aggressive children behave aggressively in perceived self-defense. This is also expected if the effect of aggressive schemas on processing is greater at earlier steps (cue interpretation steps).

Third, early social factors should influence maladaptive cognitive development, but cognition (not social factors) should predict behavior. In this case, exposure to aggression/hostility should lead to maladaptive processing, but only maladaptive processing should predict aggressive behavior. Findings suggesting that cognitive content accounts for behavioral stability over time provide some support for this assumption (Burks, Laird, Dodge, Pettit, & Bates, 1999). Another study of adolescents in residential treatment indicated that higher exposure to aggressive peers is related to higher maladaptive cognitive scripts, and both variables are related to higher hostility (Crawley, Becan, Knight, Joe, & Flynn, 2012). As expected by the SIP model, the relationship between maladaptive cognitive scripts and hostility exceeds hostility's links to exposure to aggressive peers and family. Greater maladaptive cognitive scripts also predicts physical aggression (fighting); however, for those data, the relationship between maladaptive scripts and fighting was attenuated by exposure to aggressive peers.

Results from these studies endorse the utility of the SIP models to explain problem behaviors. They also demonstrate that basic IP model components can be tested and applied to samples of youth, including substance abusing teens in treatment. However, if the basic IP model can effectively explain relationships among delinquency-related factors and engagement, the clinical implications for intervention are limited to only a few possible avenues – promoting positive peer interaction, restructuring maladaptive cognitive scripts, and addressing problem behaviors directly. A more comprehensive model that provides more information and indicates additional intervention targets (e.g., reasoning) would expand its applicability.

## **Dual-Processing Models Explain Cognitive Development**

According to Klaczynski and Cottrell (2004) dual-processing (DP) models propose that decision-making is performed by the interaction of two cognitive systems: the experiential and the analytical. It is thought that the experiential system is quick and heuristic, whereas the analytic system is slower and more deliberate. Quick, everyday decisions, such as which route to take to work or whether or not to speed through a yellow light, are thought to be handled by a greater reliance on the experiential system. Decisions requiring more systematic, logical thinking, such as which college to attend or which house to buy, are thought to be handled by greater reliance on the analytic system.

The integrated judgment and decision-making model (IJDM) proposed by Dansereau, Knight, and Flynn (2013), is a recent reformulation of DP that incorporates schema theory. In addition to the two processing systems, the IJDM model emphasizes two additional components – metacognition and expertise (wisdom). Metacognition is conceptualized as a separate self-regulatory process that controls changes in one’s reliance on experiential or analytical decision-making. The expertise system is proposed to represent the intersect or interaction between experiential and analytic allowing cues and cue processing routines to be integrated into schemas. The IJDM model suggests that expertise may account for decision-making differences between adolescents and adults, or new learners and “experts.”

According to this model, an individual perceives stimuli (external/social cues) which are compared to stimuli (internal cues) already stored in the episodic memory. Schemas (groups of related cues) can be used to compare chunks of incoming cues. If incoming and existing cues match, the individual will rely heavily on the experiential system to handle

decision-making. This system activates the appropriate response heuristics (quickly accessible algorithms). If no match is found, the individual will then rely more heavily on metacognition and analysis.

Analytic processing is thought to provide building blocks for schemas by investigating new stimuli using existing information. It is suggested that as analytic processing identifies links between new and existing stimuli, the expertise system integrates these data into schemas. The new or enhanced schemas are perhaps then stored in episodic memory in traces or in fuller form where they are, at least in part, accessible to the experiential system. Thus, exposure to new stimuli, and integration of those stimuli into existing schemas increase an individual's ability to process information more rapidly and accurately.

While it is possible that these interactions produce positive results such as expertise in a field of study, it also seems possible that the same processes also produce a type of expertise in delinquency, criminality, or aggression. Over time, existing schemas become more sophisticated enabling efficient processing of increasingly complex external stimuli via the experiential system. In addition, a wide gradient of stimuli trigger the same or associated decision-making heuristics. Thus, as an individual develops more expertise, analytic processing may be utilized less. This may mean that those who develop expertise in criminality or aggression automatically assess most situations in a criminal or aggressive manner; however, this could also mean that activating metacognition to increase reliance on analytic thinking more frequently may be a key component to addressing criminality and/or aggression.

The IJDM model is a sophisticated model that shares some important assumptions and core components with SIP. Both models assume that feedback from the episodic memory occurs throughout data processing, and both emphasize the role of schemas or scripts in influencing cue processing. Because IP models of problem behaviors are linear and include data-in and data-out steps (DP models are mostly concerned with data-in), IP core components will provide the structural framework into which the most basic DP components (processing type; experiential versus analytical processing) will be interwoven.

### **The Integrated IP-DP Model May Explain the Development of Aggression**

Although IP models have been criticized by DP proponents (Klaczynski & Cottrell, 2004), their core components are quite complementary. Retaining the six-step linear pathway suggested by SIP, the inclusion of IJDM mechanisms could improve explanatory power for both between and within individual variation. Integrating SIP and IJDM assumptions, it could be that the following steps and mechanisms occur following perception of external cues:

1. Data is encoded by comparing incoming stimuli to cues or schemas stored in episodic memory.
2. If incoming stimuli match cues/schemas stored in episodic memory, stimuli are recognized and the experiential system is heavily relied upon to process the data. If incoming stimuli do not match, metacognition triggers increased reliance on the analytic system for active processing. Thus, by either method, a mental representation is formulated.

3. Response goals (the desired gains from responding to the individual's interpretation of the data) are clarified within the relied upon system (the activated system).
4. A response appropriate to the goals and cue interpretation is sought within the activated system.
5. A response is chosen within the activated system.
6. The chosen response is manifested behaviorally.

These steps assume that the expertise mechanism is integrating data in the background. They do not assume that only one system is activated for the duration of the steps. It could be that the experiential system is used heavily for steps one through three, but upon recognizing that none of the stored response heuristics are appropriate for the perceived situation, metacognition triggers a shift favoring analytical processing for steps four through six.

Returning to maladaptive development, repeatedly exposing a child to problem behaviors would conceptually have a similar effect in the IP-DP model as in the IP model itself; however, processing style (the tendency to rely more heavily on analytic or experiential decision-making) may serve as a protective or risk-factor at some point in the steps. In one hypothetical example, a child is exposed to aggressive peers and develops hostile attribution bias. The child's tendency to utilize the experiential system to interpret neutral social stimuli would render the child more likely to demonstrate reactive aggressive responses; however, the child's tendency to rely on analytic processing to interpret social cues may attenuate reactive aggression. In another hypothetical case, a child exposed to aggressive friends develops a favorable attitude toward aggressive behaviors. The child's

tendency to utilize the experiential system may result in the automatic selection of the most commonly used or most positively evaluated response (aggressive behavior). On the other hand, a tendency to rely on the analytic system may lead to either aggressive or non-aggressive responses. If aggressive responses are evaluated positively, then an analytic child may choose to respond aggressively. However, avoiding automatic response-selection provides the opportunity to choose a non-aggressive behavior. Thus, in this case, the effect of analytic processing may be more significant on response selection steps. In either case, intervention efforts could target cue interpretations and analytic thinking in addition to peer socialization and maladaptive schemas.

### **Hypotheses and Expected Results**

This study posits that an integrated IP-DP model can provide insight about delinquency-related factors and treatment engagement. Testable components of the integrated model include: exposure to aggressive peers, maladaptive cognitive scripts, and cognitive processing style (all measured at treatment admission); delinquency-related factors (hostility, risk taking, and negative urgency; measured at admission and 35 days later); and engagement (treatment participation and peer support; measured 35 days after admission). Testing the validity of the IP-DP model involves three steps. First, the IP model is tested by examining the relationships between exposure to aggressive peers, maladaptive cognitive scripts, and delinquency-related factors. Second, the model is extended to test relationships between exposure to aggressive peers, maladaptive cognitive scripts, and treatment engagement. Third, the integration of DP components (cognitive processing style) into an IP framework is tested. Results are considered supportive of the IP-DP model dependent upon their agreement with the following hypotheses:

*Hypothesis 1:* According to Crick and Dodge (1994), the SIP model assumes behavior is related to cognitive processes, not social influences. In other words, maladaptive scripts account for behavior variability. If this is the case, higher exposure to aggression should be associated with greater maladaptive cognitive scripts. Higher exposure and greater maladaptive scripts should independently predict later delinquency-related factors; however, when controlling for maladaptive scripts, the relationship between exposure and each delinquency-related factor should become insignificant. Stated another way, maladaptive cognitive scripts should mediate the relationships between exposure to aggression and each factor (hostility, risk taking, and negative urgency). Figure 1 depicts these relationships. It is expected that the associations between maladaptive cognitive scripts and each delinquency-related factor will occur in the same direction, though the strength of relationships may vary.

H1a: Exposure to aggression will be positively correlated with hostility, risk taking, and negative urgency (delinquency-related factors).

H1b: Maladaptive cognitive scripts will mediate the relationship between exposure to aggression and delinquency-related factors.

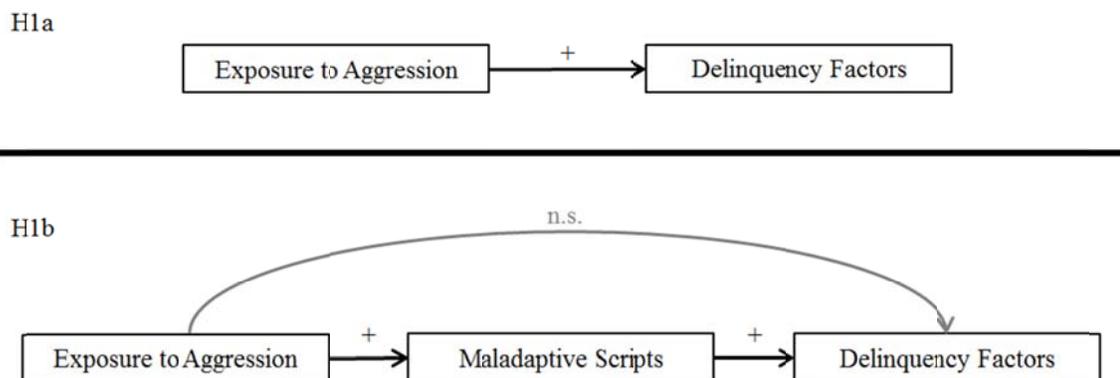


Figure 1: Hypothesis 1

*Hypothesis 2:* Research has documented that delinquency-related factors are negatively related to treatment engagement. If the SIP model predicting delinquency-related factors can be extended directly to treatment engagement, then the links between exposure to aggression, maladaptive cognitive scripts, and engagement should be similar to those predicted for delinquency-related factors.

H2a: Higher exposure to aggression will be negatively correlated with treatment engagement (treatment participation and peer support).

H2b: Maladaptive cognitive scripts will mediate the relationship between exposure to aggressive friends and engagement (see Figure 2).

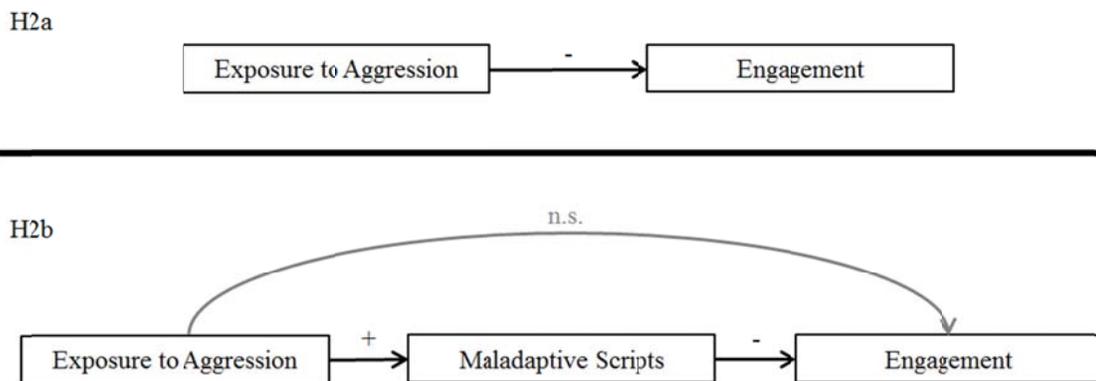


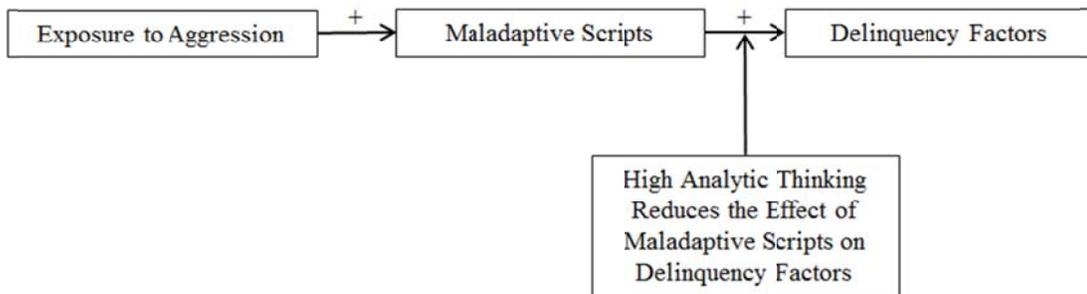
Figure 2: Hypothesis 2

*Hypothesis 3:* The IP-DP model suggests that DP components operate within an IP framework such that processing style moderates IP pathways. If this is the case, tendency to process information more analytically (versus less analytically) should attenuate the harmful effects of maladaptive cognitive scripts on delinquency-related factors and engagement. In other words, the relationship between maladaptive cognitive scripts and outcome measures (delinquency-related factors and engagement) should be dependent on dual-processing components (see Figure 3).

H3a: Analytic cognitive processing style reduces the positive correlation between maladaptive cognitive scripts and delinquency-related factors.

H3b: Analytic cognitive processing style reduces the negative correlation between maladaptive cognitive scripts and engagement measures.

H3a



H3b

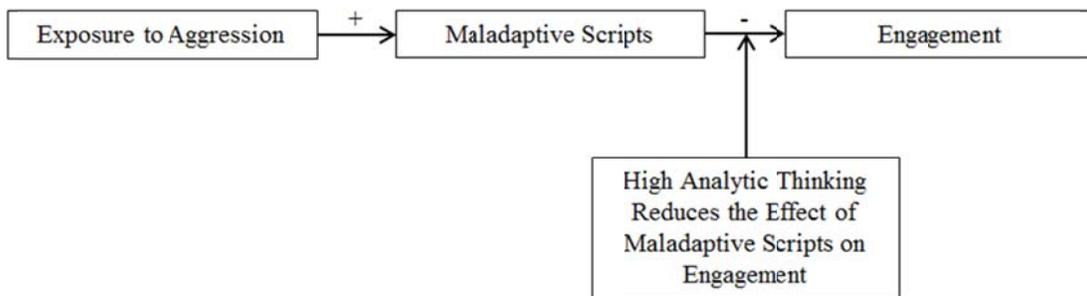


Figure 3: Hypothesis 3

### Method

Participant data were collected as a part of the Texas Christian University Adolescent Project (Knight, Becan, Landrum, Joe, & Flynn, under review) funded by the National Institute on Drug Abuse, National Institutes of Health (NIDA/NIH).

## Participants

Participants include male and female adolescents between ages 12 and 18 ( $M_{age} = 15.71$ ,  $SD_{age} = 1.02$ ;  $N = 424$ ) admitted to 8 residential substance abuse treatment programs in 3 states. Sample demographics (see Table 1) show that most clients are male ( $n = 276$ , 65%) and report their race as White ( $n = 171$ , 40%) or Hispanic ( $n = 149$ , 35%). Participants who reported being involved with the juvenile justice system within the 30 days prior to treatment admission represent over half the sample ( $n = 229$ , 54%). When asked to identify the drug that caused them the most problems, participants endorsed marijuana ( $n = 130$ , 31%), alcohol ( $n = 45$ , 11%), and ‘no problem drug’ ( $n = 74$ , 16%) most frequently. Most participants ( $n = 279$ , 66%) scored within the high drug use severity category on the TCU Drug Screen II (TCUDS II; Knight, Simpson, & Hiller, 2002).

Table 1  
*Sample Demographics*

	Participants ( $N = 424$ )
	$n$ (% of Sample)
Males	276 (65)
Race	
White	171 (40)
Hispanic	149 (35)
Multiracial	46 (11)
Black/African American	30 (7)
Other	9 (2)
Unknown	19 (5)
Age Group	
16 and older	239 (56)
15 and under	149 (35)
Unknown	36 (9)
Problem Drug	
Marijuana	130 (31)
No Problem Drug	74 (17)
Alcohol	45 (11)
Methamphetamines	31 (7)
Heroin Mixtures/Other Opiates/Downers	30 (7)
Cocaine	27 (6)
Heroin (by itself)	21 (5)
Crack/Amphetamines	16 (4)
Hallucinogens/Inhalants	12 (3)
Unknown	38 (9)
Drug Use Severity	
High Severity	279 (66)
Low Severity	94 (22)
No Score	51 (12)
Juvenile Justice Involved (30 Days Prior to Admission)	
Involved	229 (54)
Non-Involved	163 (38)
Unknown	32 (8)

Data were collected from January 2011 to November 2011. Newly admitted clients were scheduled to complete TCU assessment forms at admission (Time 1), approximately 35 days into treatment (Time 2), and approximately 90 days into treatment (Time 3). Only Time 1 and Time 2 data were utilized for this study. Of the 653 adolescents enrolled during data collection, 606 provided partial or complete assessment data, and 47 did not provide any assessment data (e.g., those not starting assessments due to being discharged within a few days of enrollment). Data exploration revealed that some participants responded to assessment form items in a systematic manner, such as selecting the response option “uncertain” or “agree” to all items on a form. This pattern was questionable because many forms included reversed items, meaning a participant intending to endorse the measured construct should answer “agree” to some items and “disagree” to reversed items. To reduce measurement error, instances of systematic responding were identified by form and administration. Form responses following this pattern were replaced with null responses. Removal of these responses reduced the sample size to 604 and reduced response data by form 1% to 4%.

High social desirability scores (Social Desirability Scale; from the CEST; see Garner, Knight, Flynn, Morey, & Simpson, 2007; Joe, Broome, Rowan-Szal, & Simpson, 2002; adapted from Crowne & Marlowe, 1960) were also used as indicators of possible response bias. Social desirability scores were considered to be high when they met or exceeded 2 standard deviations above the mean ( $M_{(Time\ 1)} = 4.19$ ,  $SD_{(Time\ 1)} = 2.44$ , cutoff score = 9.07;  $M_{(Time\ 2)} = 4.25$ ,  $SD_{(Time\ 2)} = 2.47$ , cutoff score = 9.19). The average cutoff score across Time 1 and Time 2 social desirability was 9.26. Because individual participant scores were whole integers ranging from 0 to 11, a score at or above 9 was considered high. All assessment

responses were removed for the administrations at which participants scored high on social desirability. For example, for a participant with a high social desirability score at Time 1 but not Time 2, Time 1 assessment responses were removed while Time 2 responses were kept. This data cleaning step further reduced the sample size to 588 (381 males, 207 females). Overall 10% of participants from the initial sample were excluded due to missing all assessment data, systematic response patterns, and high social desirability. Of the remaining 588 participants, those providing responses to measures of interest ( $n = 424$ ) were included in the final sample.

## Procedures

Participating facilities were recruited in 2010, with assistance from regional Addiction Technology Transfer Centers. Data collection began in January 2011, and continued until November 2011. Each facility provided residential substance abuse treatment services and planned length of stay varied. Data collection dates and planned length of stay are presented in Table 2. Approval for data collection was granted by Institutional Review

Table 2

*Data Collection and Planned Length of Stay by Facility*

Facility	Data Collection		Planned Length of Stay
	Began	Concluded	
A	1/17/2011	8/24/2011	2 months
B	1/27/2011	11/25/2011	2-6 months
C	2/25/2011	8/10/2011	2 weeks - 6 months
D	3/5/2011	9/23/2011	8 months
E	3/17/2011	11/25/2011	9-12 months
F	3/22/2011	11/22/2011	8-9 months
G	3/22/2011	11/3/2011	2 months
H	4/1/2011	11/23/2011	37 days (short-term); 5 months (long-term)

Boards at Texas Christian University and the parent agency for participating treatment programs. Facilities that chose to participate entered into a qualified service organization agreement (QSOA) with the research team. Through this arrangement, facilities gained access to assessment materials, reports, and an online assessment system in exchange for de-identified assessment data. Facilities had the option to conduct either online assessments or paper forms according to their preferences and their access to computers capable of accessing the online system.

To track clients within facilities across time, identification numbers were assigned to each client and to each facility. These identification numbers were used to link participant responses and relevant treatment data (e.g., admission date, discharge date, and discharge reason) within the online system and on paper forms. Only the facilities had access to data linking the client identification numbers to client-identifying information. The vast majority of assessments were administered online. To use the online system, each staff facilitator was assigned a log-in name and password. Client identification numbers were used as client log-in names. Facilitators scheduled and conducted online assessments by logging into the system with their assigned user names and passwords, and entering a client's identification number. During assessment administration, clients used the online system to respond to assessment items independently while being monitored by facility staff.

## **Measures**

New admissions to participating programs completed 3 rounds of assessments including the Client Evaluation of Self and Treatment (CEST; see Garner, Knight, Flynn, Morey, & Simpson, 2007; Joe, Broome, Rowan-Szal, & Simpson, 2002) which covered psychosocial functioning, engagement (Times 2 and 3 only) and motivation (Times 1 and 2

only). Clients also completed general and criminal thinking scales (CTS; Knight, Garner, Simpson, Morey, & Flynn, 2006), and the Family, Friends, and Self Form (FFS; see Simpson & McBride, 1992). The Drug Screen II and Risk forms (TCUDS II; Knight, Simpson, & Hiller, 2002; TCU RSK; see Simpson et al., 2012) gathered basic demographic data and assessed prior drug use severity. Response options for most items used a 5-point Likert-type scale (1 = *disagree strongly*, 3 = *uncertain*, and 5 = *agree strongly*). Scale scores were calculated by summing client responses to scale items, dividing the sum by the number of items (creating an average), and multiplying the average by 10 (scores ranged from 10 to 50).

**Exposure to Aggressive Friends.** The Exposure to Aggressive Friends Scale (ETAF;  $\alpha = .80$ ; Crawley, Becan, Knight, Joe, & Flynn, 2012) measured the degree to which respondents agreed or disagreed that their friends engage in antisocial and aggressive activities (e.g., “You have friends who have damaged other people’s property”). ETAF comprised 4 items and was a subset of the 7-item Peer Trouble Scale from the CEST. The 3 items that were removed from the Peer Trouble Scale referenced drug use or made no reference to aggressive behaviors. ETAF was measured only at admission.

**Maladaptive Cognitive Scripts.** The basic IP model suggests that maladaptive cognitive scripts reflects an oversensitivity to rejection, and the belief that the world is full of aggressive people (Siegel, Welsh, & Senna, 2006). The Maladaptive Cognitive Scripts Scale (MCS;  $\alpha = .81$ ; Crawley, Becan, Knight, Joe, & Flynn, 2012) measured the degree to which the respondent tends to react aggressively to rejection (e.g., “If someone disrespects you then you have to straighten them out, even if you have to get physical”) and believes aggression is

a necessary defensive behavior (e.g., “The only way to protect yourself is to be ready to fight”). MCS comprised 4 items from the Power Orientation Scale (TCU CTS). Only the Time 1 measure was utilized.

**Delinquency-Related Factors.** The Hostility Scale from the CEST ( $\alpha = .83$ ) included 8 items and measured a respondent’s temper and tendency to intimidate others (e.g., “Your temper gets you into fights or other trouble”). Likewise from the CEST, the Risk taking Scale ( $\alpha = .75$ ) included 7 items and measured a respondent’s tendency to take chances (e.g., “You like to take chances”). The Negative Urgency Scale (TCU ADOL THKFORM A;  $\alpha = .83$ ; Knight, Becan, Landrum, Joe, & Flynn, under review; adapted from Whiteside & Lynam, 2001) included 6 items and measured a respondent’s tendency to behave impulsively under the influence of negative emotions (e.g., “When I am upset I often act without thinking”). These scales were measured at Times 1 and 2.

**Engagement.** The Treatment Participation Scale from the CEST ( $\alpha = .89$ ) measured the respondent’s perception of the quality of his/her engagement in the treatment process (e.g., “You always attend the counseling sessions scheduled for you”). Also from the CEST Engagement domain, the Peer Support Scale ( $\alpha = .77$ ) measured the degree to which the respondent perceived support from treatment peers. These scales were measured at Time 2.

**Cognitive Processing Style.** To develop the cognitive processing style (CP) measure, items from the Premeditation ( $\alpha = .85$ ; Knight, Becan, Landrum, Joe, & Flynn, under review; adapted from Whiteside & Lynam, 2001) and Decision Making ( $\alpha = .77$ ; from the CEST) Scales were evaluated by principle components analysis. Eigenvalues indicated that inclusion of all items in a single factor accounted for 39% of the response variance, whereas a 2-factor solution accounted for 11%. Both possible solutions had eigenvalues

greater than 1. Items from the decision-making scale that seemed related to decision-making behaviors rather than cognitive processes were excluded, and a second principle components analysis was conducted. Eigenvalues greater than 1 suggested that inclusion of all remaining items into one factor would account for 51% of the variation in responses. A multiple factor solution (dividing items into 2 or more factors) reduced the response variance explained to 10% and less. The standardized Cronbach's alpha value for the remaining 9 items was .87, and the standardized alpha values for each item were above .80 indicating that, in addition to making conceptual sense, the items constituting CP seemed to be reliable as a single measure. The final CP measure comprised all 6 premeditation items and 3 decision-making items. CP items and standardized alpha values are presented in Table 3.

Table 3  
*Cognitive Processing Style: Items and Reliability Values*

Item	Source	Standardized $\alpha$
Before making up my mind, I consider the advantages and disadvantages.	Premeditation Scale	0.85
I am a cautious person.	Premeditation Scale	0.87
I tend to follow a rational, "sensible" approach to things.	Premeditation Scale	0.87
I usually think carefully before doing most things.	Premeditation Scale	0.85
I like to stop and think things over before I do them.	Premeditation Scale	0.85
I usually make up my mind through careful thinking.	Premeditation Scale	0.85
You plan ahead.	Decision Making Scale	0.87
You make decisions without thinking about consequences. <sup>®</sup>	Decision Making Scale	0.87
You examine problems by looking at all the choices.	Decision Making Scale	0.86

<sup>®</sup>Denotes the item was reversed.

Overall reliability  $\alpha=.87$ .

A conceptual split was used to dichotomize CP into high and low analytic processing during post hoc tests. Scores above 30 indicated the participants agreed more than they disagreed with most items and scores at and below 30 indicated the participants were uncertain or disagreed more than they agreed with most items. Therefore, scores above 30 were classified as high analytic (coded as 1), and scores of 30 and below were classified as

low analytic (coded as -1). High analytic participants totaled 232 (135 males, 67 females), and low analytic participants totaled 192 (111 males, 81 females).

All scales, with the exception of dichotomized CP, were continuous measures ranging from 10 to 50. Several scales included reverse-scored items (e.g., “You only do things that feel safe,” from the Risk taking Scale). These items were reflected prior to calculating scale scores by subtracting the client response on that item from 6. For all continuous scales, higher raw scores indicated the respondent endorsed more of the measured construct (e.g., higher exposure to aggressive peers, higher maladaptive cognitive scripts, and higher hostility). Several scales, however, were reverse square root transformed to improve distribution normality, thus, during analyses, higher scores for exposure to aggressive friends, Time 1 and Time 2 negative urgency, and engagement measures indicated the respondent disagreed with or endorsed less of the construct (lower exposure, lower negative urgency, lower treatment engagement).

### **Analytic Approach**

Analytic procedures followed those used previously or suggested in the literature (Baron & Kenny, 1986; Bulmer, 1979; Chen, Ender, Mitchell, & Wells, 2003; Langkamp, Lehman, & Lemeshow, 2010; Preacher & Leonardelli, 2013; SAS Institute Inc., 2010; Sobel, 1982; Tabachnic & Fidell, 2007; Wilkinson, & The APA Task Force on Statistical Inference, 1999). Analyses were conducted in two phases. The first phase included scale creation (cognitive processing style measure), assumptions and missingness testing, and multiple imputation (MI) procedures. The second phase included hypothesis testing and post hoc analyses. To test assumptions for multiple linear regression and multiple imputation, univariate sample distribution statistics, multivariate scatterplots, residual plots, and bivariate

correlations among independent variables were computed. Follow-up multicollinearity tests were conducted using variance inflation, tolerance, and collinearity diagnostic statistics. To create the cognitive processing style measure, principle components analysis, exploratory factor analysis, and Cronbach's alpha coefficients were calculated for candidate items. Missingness analyses were conducted using frequency counts, followed by Chi-Square analyses comparing group proportionality, logistic regression testing predictors of missingness, and analysis of covariance models testing for differences in variables of interest across background characteristics. Multiple imputation was conducted using the Markov chain Monte Carlo method and five imputed datasets were created. Additional descriptive and distribution statistics were computed for each imputed dataset.

Hypothesis testing was conducted using multiple linear regression. Mediation models in hypotheses 1 and 2 were tested using methods suggested by Baron and Kenny (1986). Three criteria must be met to conclude mediation: 1) A significant relationship between the independent variable and the mediator variable, 2) a significant relationship between the independent and dependent variables, and 3) a significant relationship between the mediator and the dependent variables. If the initial criteria were met, the effect of the mediator was tested by including both the independent variable and mediator into a model predicting the dependent variable. The effect of the mediator was considered to be full mediation if the relationship between the independent and dependent variables was no longer statistically significant. If the strength of the relationship between the independent and dependent variables was reduced when controlling for the mediator, the effect of the mediator was considered partial mediation. Sobels's test (Sobel, 1982) was used to approximate significance for the indirect effect of the predictor to the dependent measure.

Moderation models predicted by hypothesis 3 were also tested using the procedures suggested by Baron and Kenny (1986). An interaction term was created equaling the product of maladaptive cognitive scripts and cognitive processing style. The interaction term, both main effects, exposure to aggressive friends, and covariates were simultaneously entered into a model predicting each dependent variable. Moderation was concluded if the main effect of the interaction term was significant. Post hoc analyses were conducted using separate multiple regression models at each level of the dichotomized moderator. For post hoc models, cognitive processing style was dichotomized where -1 indicated low analytic thinking (a score of 30 or less) and 1 indicated high analytic thinking (scores above 30).

## **Results**

### **Assumptions Testing**

Assumptions testing for multiple regression was conducted prior to multiple imputation procedures and followed recommended procedures (Tabachnick & Fidell, 2007). Univariate analyses and normality assessments were conducted first. Deviations from normality degrade multivariate regression results as well as render multivariate non-normality more likely. Normally distributed data were expected to have skewness and kurtosis values close to zero. The general guidelines for interpreting skewness are: Values less than -1 or greater than 1 indicate data are highly skewed; absolute values of ½ to 1 indicate moderately skewed data; and absolute values closer to 0 indicate close proximity to normality. For kurtosis, the general guidelines indicate values between -2 and 2 approximate an acceptable range (Bulmer, 1979). Shapiro-Wilk statistics were non-significant for Time 1 hostility and Time 2 risk taking, meaning they did not statistically deviate from normality. Among measures deviating significantly from normality according to Shapiro-Wilk statistics,

most were within an absolute value of .20 or less from zero. Skewness for Time 2 negative urgency fell within the moderate range of skewness. Other variables approaching this range included exposure to aggressive friends, Time 1 negative urgency, Time 2 peer support, and Time 2 treatment participation. These variables were also more significantly non-normal than other measures. Because these variables were negatively skewed, a common transformation used to correct moderate negative skew, reversed square root transformation, was applied (Tabachnick & Fidell, 2007; Table 4). These transformations resulted in improved skewness and kurtosis values that fell well within a normal range and more closely matched the distributions of the other variables. These transformations were retained through subsequent analyses.

Table 4  
Univariate Descriptive and Distribution Statistics

	<i>n</i>	<i>M</i>	<i>SD</i>	Skew	Kurtosis	Variance	Range	Shapiro-Wilk Statistic	<i>p</i>
Raw Measures									
Maladaptive Cognitive Scripts	353	30.25	8.86	0.07	-0.16	78.56	10-50	.98	.0002
Exposure to Aggressive Friends	369	33.41	9.27	-.41	-.50	85.98	10-50	.97	<.0001
Cognitive Processing Style	354	30.72	7.49	-.18	-.12	56.11	10-50	.99	.0250
Hostility (Time 1)	360	28.50	8.17	.18	-.19	66.76	10-50	.99	.0574
Hostility (Time 2)	341	29.60	7.75	.04	-.29	60.01	10-50	.99	.0499
Risk Taking (Time 1)	360	34.40	6.40	.08	-.26	40.97	10-50	.99	.0398
Risk Taking (Time 2)	341	34.28	6.33	.03	-.16	40.04	10-50	.99	.1218
Negative Urgency (Time 1)	354	32.29	7.99	-.31	-.07	63.89	10-50	.99	.0013
Negative Urgency (Time 2)	334	32.67	7.96	-.56	.19	63.39	10-50	.97	<.0001
Peer Support (Time 2)	329	35.10	6.37	-.38	.64	40.60	10-50	.98	<.0001
Treatment Participation (Time 2)	330	39.69	5.09	-.30	.61	25.87	10-50	.98	<.0001
Transformed Measures <sup>a</sup>									
Exposure to Aggressive Friends	369	15.87	2.86	0.09	-0.57	8.21	10-22.36	0.99	0.0009
Negative Urgency (Time 1)	354	16.28	2.46	-0.05	-0.13	6.04	10-22.36	0.99	0.2562
Negative Urgency (Time 2)	334	16.19	2.42	0.18	0.08	5.86	10-22.36	0.98	0.0012
Peer Support (Time 2)	329	15.47	2.04	-0.12	0.45	4.18	10-22.36	0.99	0.0018
Treatment Participation (Time 2)	330	13.95	1.81	-0.15	0.01	3.29	10-22.36	0.98	<.0001

Note. Skewness ranges are: Less than -1 or greater than 1, high skew; absolute values between .50 and 1, moderate skew; absolute values between 0 and .50 approximate normal. Kurtosis values falling between -2 and 2 are acceptable (Bulmer, 1979).

<sup>a</sup> Reversed square root transformation applied.

Multivariate normality and linearity were explored second. Graphical examinations of multivariate scatterplots and residual plots using transformed variables indicated no significant deviations from linearity, multivariate normality, or homoscedasticity. Bivariate Pearson Product Moment correlation statistics were computed between the intended

independent variables (see Table 5). Because variables were significantly correlated, follow-up preliminary multivariate regression models were conducted to test for multicollinearity. Multicollinearity among variables can cause regression estimates to become inflated and instability within the models. Diagnostics revealed that variance inflation and tolerance statistics were within acceptable ranges (variance inflation factor less than 10; tolerance value greater than 0.1) and collinearity diagnostics provided no indications of significant multicollinearity or global instability (instability is indicated by condition index values at 10 or greater; Tabachnick & Fidell, 2007; Chen, Ender, Mitchell, & Wells, 2003). The assumptions for multiple linear regression were considered met. Likewise, the multiple imputation assumption that data to be imputed are drawn from a normal distribution was also considered met.

Table 5  
*Independent Variable Correlations*

	1	2	3	4	5	6
1. Maladaptive Cognitive Scripts ( <i>n</i> =353)	1.00					
2. Exposure to Aggressive Friends ( <i>n</i> =369)	0.40***	1.00				
3. Cognitive Processing Style ( <i>n</i> =354)	-0.17**	-0.20***	1.00			
4. Time 1 Hostility ( <i>n</i> =360)	0.64***	0.47***	-0.21***	1.00		
5. Time 1 Risk Taking ( <i>n</i> =360)	0.28***	0.41***	-0.40***	0.40***	1.00	
6. Time 1 Negative Urgency ( <i>n</i> =354)	0.38***	0.37***	-0.22***	0.58***	0.39***	1.00

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

## Missing Data

Participant data were provided by facility staff members (enrollment, demographic, and treatment episode data) and the participants themselves (assessment data). Six hundred fifty three adolescents (432 males, 221 females) were enrolled in treatment during data collection. Of those enrolled, some did not complete any assessment administrations or forms (assessment data were completely missing), some did not complete assessments at both Times 1 and 2 (missing an assessment administration), and others did not complete all

assessment forms administered at a particular time point (incomplete data; missing forms). The term “missing” refers to all 3 instances when data that is expected is unavailable (completely missing, missing an administration, and missing forms at a particular administration period). Missing data were expected; thus, analyses were conducted to determine the most appropriate method of handling missing data in subsequent hypothesis testing. First, missing administration data were explored by categorizing participants into 1 of 7 orthogonal groups representing each possible response type pattern occurring across Time 1 and Time 2 (see Table 6). Response types included 3 categories. First, those

Table 6  
*Missing Data: Assessment Administration Response Type Patterns and Inclusion Classification*

Time 1	Time 2	Participants	Group Classifications		
			Explained Missing	True Missing	Inclusion (I)/Exclusion (E)
R	R	332	--	--	I
R	D	166	--	--	E
R	N	67	--	--	I
D	--	18	2	16	E
N	R	33	27	6	I
N	N	22	9	13	E
N	D	15	6	9	E

*Note.* R = response, D = discharged within administration window (no response), N = present throughout administration window but did not respond

participants providing at least partial data (response; R) were distinguished from those not providing any data (non-response; N) by assessment administration. Then, non-response participants were further divided into 2 subgroups differentiated by whether the client was available for assessment completion for the duration of the administration window (N), or was unavailable for part of the assessment window due to discharge from the facility (non-response with discharge; D). Participants who were discharged within the missing assessment’s administration window were isolated because it was unknown whether they would have been missing or non-missing if the participant had remained in treatment longer.

Participants who did not complete any assessment administrations (completely missing) totaled 47 (7% of the sample). There were 332 (51% of the sample) participants with complete Time 1 and Time 2 assessment data and 274 (42% of the sample) participants missing data at one administration (either Time 1 or Time 2). Further exploration of non-response and discharge participants revealed that some participants' online assessment accounts were created after the missing assessment administration's window was closed. In other words, of clients missing Time 1 assessment data ( $n = 88$ , 13% of the sample), 44 were due to delays in data collection. Because these missing data were explainable, they were classified as explained missing. Missing data that were not explainable by data collection delays were classified as truly missing ( $n = 277$  across both time points, 42% of the sample).

In SAS 9.2 (SAS Institute Inc., 2010) the default method of handling missing data in regression is listwise deletion. The American Psychological Association cautioned against the use of listwise deletion and recommended other strategies for handling missing data (Wilkinson, & The APA Task Force on Statistical Inference, 1999). Langkamp, Lehman, and Lemeshow (2010) suggested reweighting or multiple imputation techniques when missing data represent more than 10% of the sample. Multiple imputation using PROC MI produces a user-specified number of datasets, identified by imputation number, each of which contains the non-missing original data points as well as possible values substituted for missing data points. Multiple regression analyses are conducted by imputation number, then PROC MIANALYZE is used to calculate the average parameter estimates. This method is preferable because it reflects the uncertainty that exists when missing data are present and provides a range of likely results (SAS Institute Inc., 2010). In addition, it was demonstrated with a similar sample that the covariance matrices for multiply imputed datasets were

statistically no different than the covariance matrices of the non-imputed sample (Crawley, Knight, Flynn, 2013). Multiple imputation assumes data are missing at random (MAR) meaning missingness in variable A predicted by variable B is allowable, but data are not MAR if missingness in variable A can be predicted by itself (variable A). Tests of missingness were conducted in order to reasonably establish that there was no evidence that data were not MAR.

Frequency tables comparing clients missing all assessment administration data to participants with complete assessment data revealed that nearly all of the participants missing all assessment data were additionally missing demographic data rendering formal comparison tests impossible. Alternatively, missingness tests were conducted comparing participants whose data could be included versus participants whose data could not be included in multiple imputation. The criteria for inclusion in multiple imputation were considered met if data were missing at only one assessment administration and the participant was considered a non-responder (N). Data were excluded from multiple imputation if they were missing at both administrations or were considered non-responders due to discharge (D). Thus participants comprising the inclusion group ( $n = 432$ ) were those with complete data or those missing data at only one administration despite having been in treatment for the duration of the administration's assessment window. Participants comprising the exclusion group ( $n = 221$ ) were those missing all assessment data or those who were discharged prior to completing assessments.

Frequency distributions of inclusion/exclusion groups by background characteristics indicated possible relationships between inclusion and age, ethnicity (Hispanic/Non-Hispanic), and juvenile justice involvement (involved/non-involved in the juvenile justice system within the 30 days prior to admission to treatment). Inclusion group distributions across gender, race, drug use severity, and treatment history were similar. Chi-square analyses were conducted to test for inclusion group disproportionality by ethnicity and juvenile justice involvement. Results indicated that juvenile justice involvement was proportionally similar by group ( $\chi^2(1) = 2.54, p = .11$ ), but non-Hispanic participants were disproportionately represented in the exclusion group ( $\chi^2(1) = 14.87, p < .001$ ). Logistic regression predicting exclusion by age was conducted. Results indicated that age was not a significant predictor of exclusion ( $\beta = -.04, SE = .09, \chi^2 = .20, p = .65$ ).

Additional analysis of covariance tests were conducted comparing the inclusion and exclusion groups on variables of interest. Because ethnicity appeared to be related to exclusion, its main effect and interaction with exclusion was added as a covariate in ANCOVA analyses with inclusion group as the factor, Time 1 measures of interest as dependent measures, and ethnicity X exclusion as covariates. Results are presented in Table 7. Controlling for ethnicity and the exclusion by ethnicity interaction, there were no significant differences between inclusion/exclusion participants on any of the variables of interest. Significant main effects for ethnicity were observed for Time 1 maladaptive cognitive scripts, exposure to aggressive peers, and risk taking. Because differences between inclusion and exclusion groups were only observed for ethnicity, the missing at random assumption was considered met. Ethnicity was included as a covariate in all subsequent hypothesis testing analyses.

Table 7

*Analysis of Covariance Comparing Inclusion Groups on Variables of Interest*

Dependent Variable	<i>df</i>	Exclusion/Inclusion	Ethnicity	Exclusion*Ethnicity
		<i>F</i> Value	<i>F</i> Value	<i>F</i> Value
Maladaptive Cognitive Scripts	3, 543	0.48	11.35***	1.08
Exposure to Aggressive Friends	3, 562	0.04	5.07*	0.01
Cognitive Processing Style	3, 554	0.02	0.12	0.85
Time 1 Hostility	3, 557	1.57	0.03	0.36
Time 1 Risk Taking	3, 556	0.11	9.03**	0.00
Time 1 Negative Urgency	3, 554	1.37	0.53	0.79

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

To prepare for multiple imputation, PROC MI was used to analyze patterns of missing data. Data missingness among variables of interest was relatively random (e.g., missingness did not follow a monotone pattern), thus the Markov chain Monte Carlo (MCMC) method was selected as the most appropriate method of imputation (SAS Institute Inc., 2010). PROC MI was used to produce 5 imputed datasets from the sample. The minimum and maximum values were set for each variable to be imputed. The ranges of untransformed variable descriptive statistics across all 5 imputed datasets are displayed in Table 8.

Table 8

*Range of Sample Descriptive Statistics for Five Imputed Datasets*

Measure	<i>n</i>	<i>M</i>	<i>SD</i>	Minimum	Maximum
Maladaptive Cognitive Scripts	421	29.99-30.31	8.73-9.01	10.00	50.00
Exposure to Aggressive Friends	421	33.05-33.36	9.17-9.29	10.00	50.00
Cognitive Processing Style	421	30.57-30.88	7.50-7.68	10.00	50.00
Time 1 Hostility	421	28.28-28.53	8.05-8.29	10.00	50.00
Time 2 Hostility	421	29.25-29.38	7.61-7.90	10.00	48.75
Time 1 Risk Taking	421	34.19-34.49	6.19-6.41	17.14	50.00
Time 2 Risk Taking	421	34.08-34.22	6.20-6.34	14.29	50.00
Time 1 Negative Urgency	421	31.94-32.19	7.90-8.12	10.00	50.00
Time 2 Negative Urgency	421	32.26-32.71	7.88-8.05	10.00	50.00
Time 2 Peer Support	421	39.51-39.79	4.87-5.08	21.67	50.00
Time 2 Treatment Participation	421	34.87-35.51	6.22-6.39	10.00	50.00

*Note.* Descriptive statistics reflect raw (not transformed) variables.

## Hypothesis Testing

Transformed variables (reversed square root) were used in hypothesis testing and post hoc analyses. These variables were: Exposure to aggressive friends (ETAF), Times 1 and 2 negative urgency, Time 2 peer support, and Time 2 treatment participation. All hypothesis 1 models were tested using the same protocol. Each model predicting a Time 2 factor controlled for the corresponding Time 1 measure of that factor as well as ethnicity (Hispanic/Non-Hispanic) and gender. In all models estimating the relationship between ETAF and maladaptive cognitive scripts (MCS), statistical results were expected to be negative due to data transformation.

**Hypothesis 1.** Hypotheses 1a and 1b predicted that maladaptive cognitive scripts would mediate the relationships between exposure to aggressive peers and the delinquency-related factors hostility, risk taking, and negative urgency (as expected by the IP model; Figure 1). Specifically, hypothesis 1a predicted exposure to aggressive friends would be positively related to Time 2 delinquency factors. Due to the use of transformed variables, the following statistical relationships were expected: ETAF to hostility, negative; ETAF to risk taking, negative; and ETAF to negative urgency, positive.

The model predicting Time 2 hostility by ETAF was significant (range  $F(4, 411) = 93.88$  to  $107.07$ ,  $p < .001$ ) and accounted for 47% to 51% of variance in Time 2 hostility (Table 9). Averaged t-test values indicated that exposure to aggression was a significant predictor of Time 2 hostility ( $t(1) = -4.33$ ,  $p < .001$ ). Squared semi-partial correlations suggested that Time 1 hostility uniquely accounted for 25% to 30% of variance in Time 2 hostility. The unique variance explained by exposure to aggression ranged from 3% to 4%.

Table 9  
Hypothesis 1: Regression Coefficients, Standard Errors, and Confidence Intervals

	Time 2 Hostility				Time 2 Risk Taking				Time 2 Negative Urgency <sup>®</sup>			
	$\beta$	SE	95% CI		$\beta$	SE	95% CI		$\beta$	SE	95% CI	
Lower			Upper	Lower			Upper	Lower			Upper	
<b>Hypothesis 1a: Exposure to Aggressive Friends</b>												
Exposure to Aggressive Friends <sup>®</sup>	-.53***	.12	-.78	-.29	-.23 <sup>†</sup>	.12	-.46	.01	.18***	.05	.08	.27
Ethnicity	.51	.61	-.68	1.71	-.55	.68	-1.91	.81	-.10	.23	-.56	.36
Gender	-.16	.71	-1.59	1.27	.41	.60	-.78	1.60	-.02	.23	-.47	.43
Time 1 Covariate	.56***	.04	.48	.65	.46***	.05	.36	.57	.40***	.06	.27	.53
<b>Hypothesis 1a: Maladaptive Cognitive Scripts</b>												
Maladaptive Cognitive Scripts	.19**	.06	.07	.32	.04	.04	-.04	.13	-.08***	.02	-.11	-.05
Ethnicity	.45	.62	-.78	1.67	-.46	.63	-1.71	.79	-.05	.22	-.48	.39
Gender	.20	.71	-1.24	1.63	.47	.62	-.77	1.70	-.16	.23	-.62	.30
Time 1 Covariate	.52***	.06	.40	.64	.49***	.05	.40	.58	.37***	.06	.24	.50
<b>Hypothesis 1b: Mediation Model</b>												
Exposure to Aggressive Friends <sup>®</sup>	-.48***	.12	-.72	-.23	-.20	.13	-.46	.06	.12 <sup>°</sup>	.05	.02	.21
Maladaptive Cognitive Scripts <sup>a</sup>	.17**	.06	.05	.29	.03	.04	-.07	.12	-.07***	.02	-.10	-.04
Ethnicity	.25	.61	-.95	1.44	-.60	.66	-1.91	.70	.002	.22	-.43	.44
Gender	.06	.70	-1.36	1.48	.45	.62	-.78	1.68	-.13	.23	-.59	.32
Time 1 Covariate	.46***	.06	.33	.58	.46***	.05	.36	.56	.33***	.07	.19	.47

<sup>a</sup> ETAF predicting MCS controlling for Ethnicity and Gender  $\beta = -1.20$ ,  $SE = .15$ , 95% CI Lower -1.50, Upper -.90, significant at  $p < .001$ .

<sup>®</sup> Denotes a reverse square root transformed measure.

<sup>†</sup>  $p < .10$ . <sup>\*</sup>  $p < .05$ . <sup>\*\*</sup>  $p < .01$ . <sup>\*\*\*</sup>  $p < .001$ .

The omnibus model predicting Time 2 risk taking by ETAF was significant (range  $F(4, 411) = 32.96$  to  $45.24$ ,  $p < .001$ ) accounting for 24% to 30% of variance in Time 2 risk taking. Time 1 risk taking uniquely accounted for 15% to 20% of Time 2 risk taking variance. ETAF was a marginally significant predictor ( $t(1) = -1.94$ ,  $p = .06$ ) uniquely accounting for 1% of variance in Time 2 risk taking.

The model predicting Time 2 negative urgency by ETAF was also significant (range  $F(4, 411) = 34.28$  to  $45.34$ ,  $p < .001$ ), accounting for 24% to 30% of variance in Time 2 negative urgency. Time 1 negative urgency uniquely contributed 11% to 18% to Time 2 variance. ETAF was a significant predictor ( $t(1) = 3.85$ ,  $p < .001$ ) and uniquely accounted for 3% to 5% of Time 2 negative urgency variance.

Overall, exposure to aggressive peers was a predictor for each Time 2 delinquency-related factor, although only marginally so for risk taking. Therefore the null hypothesis predicting that exposure to aggressive friends is not related to delinquency-related factors was rejected.

Hypothesis 1b predicted that maladaptive cognitive scripts would mediate the relationships between exposure to aggressive friends and delinquency-related factors. First,

regression models testing the relationships between maladaptive scripts and each Time 2 dependent measure, controlling for the Time 1 measure of the outcome variable, ethnicity, and gender were conducted. Then, both exposure and maladaptive scripts were entered simultaneously into models predicting Time 2 dependent measures controlling for the dependent measure's Time 1 variable, ethnicity, and gender. Due to data transformations, the following statistical relationships were expected: MCS to hostility, positive; MCS to risk taking, positive; and MCS to negative urgency, negative.

**Time 2 Hostility.** Maladaptive cognitive scripts was a significant predictor of Time 2 hostility ( $t(1) = 3.30, p < .01$ ), uniquely accounting for 2% to 5% variance after controlling for Time 1 hostility (uniquely contributing 14% to 20% variance), ethnicity, and gender (Table 9). The omnibus model was significant (range  $F(4, 411) = 97.64$  to  $103.98, p < .001$ ) and accounted for 48% to 50% variance in Time 2 hostility. The omnibus model testing mediation was significant (range  $F(5, 411) = 84.46$  to  $90.84, p < .001$ ) accounting for 50% to 52% of the variance in Time 2 hostility. Unique variance contributions among predictors were ETAF 2% to 3%, MCS 1% to 4%, and Time 1 hostility 10% to 14%. Exposure to aggression remained a significant predictor of Time 2 hostility, but with reduced significance indicating partial mediation. Maladaptive scripts also remained a significant predictor of Time 2 hostility. Exposure to aggression was a significant predictor of maladaptive scripts ( $t(1) = -7.91, p < .001$ ), uniquely accounting for 14% to 16% of MCS variance. The Sobel test calculator (Preacher & Leonardelli, 2013) was used to compute the Sobel test statistic which indicated that the indirect effect of exposure to aggression on Time 2 hostility via maladaptive cognitive scripts was significant (Sobel statistic =  $-2.67, SE = .08, p < .01$ ).

**Time 2 Risk Taking.** Maladaptive cognitive scripts was not a significant predictor of Time 2 risk taking ( $t(1) = 1.10, p = .28$ ) and uniquely accounted for less than 1% of Time 2 risk taking variance after controlling for Time 1 risk taking (19% to 30% unique variance contribution), ethnicity, and gender. The omnibus model was significant (range  $F(4, 411) = 23.15$  to  $45.91, p < .001$ ) and accounted for 23% to 29% variance in Time 2 risk taking. The full risk taking model including ETAF and MCS as predictors was significant (range  $F(5, 411) = 26.30$  to  $37.06, p < .001$ ) accounting for 24% to 30% of the variance. Unique variance contributions among predictors were ETAF  $< 1\%$ , MCS  $< 1\%$ , and Time 1 risk taking 14% to 17%. Neither exposure to aggression ( $t(1) = -1.53, p = .13$ ), nor maladaptive scripts were significant predictors ( $t(1) = .57, p = .57$ ). Maladaptive scripts did not mediate the relationship between ETAF and Time 2 risk taking.

**Time 2 Negative Urgency.** Maladaptive cognitive scripts was a significant predictor of Time 2 negative urgency ( $t(1) = -5.17, p < .001$ ) uniquely accounting for 6% to 9% variance after controlling for Time 1 negative urgency (9% to 15% unique contribution), ethnicity, and gender. The omnibus model was significant (range  $F(4, 411) = 42.33$  to  $53.09, p < .001$ ) and accounted for 29% to 34% variance. The omnibus model testing mediation was also significant (range  $F(5, 411) = 36.89$  to  $43.96, p < .001$ ) accounting for 30% to 34% of Time 2 negative urgency variance. Unique variance contributions among predictors were ETAF 1% to 2%, MCS 3% to 6%, and Time 1 negative urgency 6% to 12%. Exposure to aggression remained a significant predictor of Time 2 negative urgency, but with reduced significance ( $t(1) = 2.55, p < .05$ ) indicating partial mediation. Maladaptive cognitive scripts also remained a significant predictor of Time 2 negative urgency ( $t(1) = -4.37, p < .001$ ).

Sobel test statistics indicated that the indirect effect of ETAF on Time 2 negative urgency via MCS was significant (Sobel statistic = -3.21,  $SE = .03$ ,  $p < .01$ ).

**Hypothesis 2.** Hypotheses 2a and 2b extended expected IP relationships to engagement measures. Specifically, hypothesis 2a predicted greater exposure would be related to lower engagement (Time 2 peer support and treatment participation). Hypothesis 2a was tested using separate regression models predicting each treatment engagement measure by exposure to aggressive friends. The relationships were expected to be negative, meaning greater exposure would predict lower engagement. Due to scale transformations the following statistical relationships were expected: ETAF to peer support, negative; and ETAF to treatment participation, negative. The model predicting Time 2 peer support by exposure to aggression, was significant (range  $F(3, 411) = 2.71$  to  $4.35$ ,  $p < .04$  to  $.01$ ) accounting for 1% to 2% variability in Time 2 peer support; however, exposure to aggression was not a significant predictor ( $t(1) = -.69$ ,  $p = .49$ ). The model for Time 2 treatment participation was not significant (range  $F(3, 411) = .40$  to  $1.95$ ,  $p = .75$  to  $.12$ ). Likewise, exposure to aggressive friends was not a significant predictor ( $t(1) = -.76$ ,  $p = .46$ ) of treatment participation.

Table 10  
Hypothesis 2: Regression Results for Predictor Maladaptive Cognitive Scripts

	Time 2 Peer Support <sup>®</sup>				Time 2 Treatment Participation <sup>®</sup>			
	$\beta$	SE	95% CI		$\beta$	SE	95% CI	
			Lower	Upper			Lower	Upper
<b>Hypothesis 2a: Exposure to Aggressive Friends</b>								
Exposure to Aggressive Friends <sup>®</sup>	-.03	.04	-.10	.05	-.04	.05	-.14	.07
Ethnicity	-.59**	.23	-1.03	-.14	-.16	.21	-.57	.25
Gender	.30	.22	-.14	.74	-.04	.23	-.51	.44
<b>Hypothesis 2b: Maladaptive Cognitive Scripts</b>								
Maladaptive Cognitive Scripts	.01	.01	-.01	.04	.03**	.01	.01	.05
Ethnicity	-.60**	.23	-1.04	-.16	-.20	.20	-.60	.21
Gender	.32	.22	-.12	.76	-.002	.23	-.48	.48

<sup>®</sup>Denotes a reverse square root transformed measure.

\*\*  $p < .01$

Hypothesis 2b predicted maladaptive scripts would mediate the relationships between exposure and engagement. Two regression models were planned to test Hypothesis 2b.

Model 1: Time 2 engagement measures predicted by maladaptive cognitive scripts (expected statistical relationships: MCS to both peer support and treatment participation, positive).

Model 2: Time 2 engagement measures predicted by exposure and maladaptive scripts. The model predicting Time 2 peer support by maladaptive cognitive scripts controlling for ethnicity and gender was significant (range  $F(3, 411) = 3.03$  to  $4.70$ ,  $p < .03$  to  $.01$ ), but only accounted for 1% to 3% of the variability in Time 2 peer support (see Table 10). MCS was not a significant predictor of Time 2 peer support ( $t(1) = 1.22$ ,  $p = .22$ ). Squared semi-partial correlations suggested that the unique variance explained by maladaptive scripts ranged from <1% to 2%. The model predicting Time 2 treatment participation by maladaptive cognitive scripts ranged from marginally significant to significant (range  $F(3, 411) = 2.49$  to  $4.81$ ,  $p = .06$  to  $< .01$ ) accounting for 1% to 3% of Time 2 treatment participation. Maladaptive scripts was a significant predictor ( $t(1) = 2.70$ ,  $p < .01$ ), but uniquely accounted for only 2% to 3% of variance in Time 2 treatment participation. Maladaptive cognitive scripts was a significant but small predictor of Time 2 treatment participation, but not a predictor of Time 2 peer support. Because the preliminary criteria for mediation were not met for either engagement measure, mediation models (planned Model 2) were not conducted.

**Hypothesis 3.** Hypothesis 3 predicted that cognitive processing style (CP) would moderate the relationships between maladaptive cognitive scripts and delinquency-related factors (3a), and the relationships between scripts and treatment engagement measures (3b). In other words, higher analytic thinking was expected to attenuate the negative effects of IP components on delinquency-related factors and engagement. Planned moderation models

included the MCS X CP interaction term, and the main effects of ETAF, MCS, and CP entered simultaneously to predict each outcome variable. All moderation models utilized transformed variables and included ethnicity and gender as covariates.

Diagnostic statistics for initial models indicated there was an unacceptable amount of variance inflation (Tabachnick & Fidell, 2007; Chen, Ender, Mitchell, & Wells, 2003). To reduce the inflation, MCS and CP variables were centered conceptually around 30, and the interaction term was recalculated as the product of the centered CP and MCS measures. Variance inflation and tolerance statistics were reduced to acceptable values; therefore, the centered main effects for MCS and CP as well as the new interaction term were used in subsequent moderation models.

Predicting hostility at Time 2, the main effects for ETAF ( $t(1) = -3.88, p < .001$ ), MCS ( $t(1) = 2.96, p < .01$ ) and hostility at Time 1 ( $t(1) = 7.44, p < .001$ ) were significant (Table 11). Each predictor uniquely accounted for 2%-3%, 1%-4%, and 10%-14% of Time 2 Hostility variance respectively. Cognitive processing and the interaction term were non-significant.

Table 11  
Hypothesis 3: Moderation Model Results Predicting Delinquency-Related Factors

	Time 2 Hostility				Time 2 Risk Taking				Time 2 Negative Urgency <sup>Ⓞ</sup>			
	β	SE	95% CI		β	SE	95% CI		β	SE	95% CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Exposure to Aggressive Friends <sup>Ⓞ</sup>	-.47***	.12	-.70	-.23	-.21	.13	-.47	.05	.11*	.05	.02	.20
Maladaptive Cognitive Scripts <sup>a</sup>	.17**	.06	.05	.28	.02	.04	-.07	.11	-.06***	.01	-.09	-.04
Cognitive Processing Style <sup>a</sup>	-.04	.05	-.13	.06	-.05	.05	-.15	.04	.04*	.02	.002	.07
Interaction (MCS X CP)	.004	.004	-.004	.01	-.003	.004	-.01	.004	-.001	.002	-.004	.002
Ethnicity	.25	.60	-.94	1.44	-.66	.66	-1.97	.65	-.005	.22	-.44	.43
Gender	.07	.71	-1.36	1.51	.36	.63	-.89	1.61	-.10	.23	-.56	.36
Time 1 Covariate	.46***	.06	.33	.58	.43***	.06	.31	.54	.32***	.06	.19	.44

<sup>a</sup>Denotes the variable was centered conceptually around 30.

<sup>Ⓞ</sup>Denotes a reverse square root transformed measure.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Predicting risk taking at Time 2, only the main effect for risk taking at Time 1 was significant ( $t(1) = 7.49, p < .001$ ). Predicting negative urgency at Time 2, the main effects for exposure to aggression ( $t(1) = 2.38, p < .05$ ), MCS ( $t(1) = -4.39, p < .001$ ), cognitive processing ( $t(1) = 2.17, p < .05$ ), and Time 1 negative urgency ( $t(1) = 5.11, p < .001$ ) were

significant. The interaction term was non-significant. Time 1 negative urgency accounted for the greatest amount of unique variance (5% - 10%), followed by MCS (3% - 5%), exposure to aggression (1% - 4%), and cognitive processing (< 1% - 2%).

Predicting peer support at Time 2, the main effect of the MCS x CP interaction term was marginally significant ( $t(1) = 1.81, p = .07$ ), and the main effect for ethnicity was significant ( $t(1) = -2.69, p < .01$ ; Table 12). Unique variance contributions were 2% - 3% by ethnicity and less than 1% to 2% by the interaction. Predicting Time 2 treatment participation, the main effect for maladaptive scripts ( $t(1) = 2.25, p < .05$ ) and the interaction term were significant ( $t(1) = .17, p < .05$ ). No other predictors were significant. Maladaptive scripts uniquely contributed around 2% of treatment participation variance, while the interaction term uniquely accounted for around 1% variance.

Table 12  
Hypothesis 3: Moderation Model Results Predicting Treatment Engagement Measures

	Time 2 Peer Support <sup>®</sup>				Time 2 Treatment Participation <sup>®</sup>			
	$\beta$	SE	95% CI		$\beta$	SE	95% CI	
			Lower	Upper			Lower	Upper
Exposure to Aggressive Friends <sup>®</sup>	-.01	.04	-.09	.07	.004	.05	-.11	.12
Maladaptive Cognitive Scripts <sup>a</sup>	.01	.01	-.01	.04	.03*	.01	.003	.05
Cognitive Processing Style <sup>a</sup>	.002	.02	-.04	.05	-.01	.02	-.05	.02
Interaction (MCS X CP)	.003 <sup>†</sup>	.001	-.0003	.006	.003*	.001	.0002	.005
Ethnicity	-.61**	.23	-1.06	-.16	-.20	.20	-.60	.21
Gender	.37	.24	-.11	.85	.02	.24	-.47	.51

<sup>a</sup>Denotes the variable was centered conceptually around 30.

<sup>®</sup>Denotes a reverse square root transformed measure.

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ .

## Post Hoc Engagement Models

To clarify the moderation effects of cognitive processing on the relationships between maladaptive scripts and engagement measures, separate multiple regression analyses were conducted for adolescents with high analytic thinking (scores above 30 indicating agreement with CP items) and those with low analytic thinking (scores at and below 30 indicating uncertainty and disagreement with CP items). All models predicting Time 2 engagement

measures at each level of CP included exposure to aggression and maladaptive scripts (centered) as predictors controlling for gender and ethnicity.

For high analytic participants, the main effect for ethnicity (non-Hispanic/Hispanic) on peer support was marginally significant ( $t(1) = -1.93, p = .05$ ; Table 13). Reporting ethnicity as Hispanic, compared to non-Hispanic, was associated with increased peer support. In the treatment participation model, the effect of maladaptive scripts was significant ( $t(1) = 2.25, p < .05$ ). Greater scripts was related to lower treatment participation. Among low analytic thinking participants, only ethnicity was a marginally significant predictor of peer support ( $t(1) = -1.83, p = .07$ ). Hispanic ethnicity was related to higher peer support. No predictors were significant in the treatment participation model.

Table 13  
*Post Hoc Results: Maladaptive Cognitive Scripts Predicting Treatment Engagement at High and Low Analytic Thinking*

	Time 2 Peer Support <sup>®</sup>				Time 2 Treatment Participation <sup>®</sup>			
	β	SE	95% CI		β	SE	95% CI	
			Lower	Upper			Lower	Upper
<b>High Analytic Participants</b>								
Exposure to Aggressive Friends <sup>®</sup>	-.03	.06	-.14	.09	-.02	.06	-.15	.11
Maladaptive Cognitive Scripts <sup>a</sup>	.03	.02	-.01	.07	.04*	.02	.004	.08
Ethnicity	-.56 <sup>†</sup>	.29	-1.14	.01	-.31	.30	-.91	.28
Gender	.61	.37	-.15	1.37	.11	.32	-.53	.76
<b>Low Analytic Participants</b>								
Exposure to Aggressive Friends <sup>®</sup>	.01	.08	-.14	.16	.03	.07	-.11	.17
Maladaptive Cognitive Scripts <sup>a</sup>	.001	.02	-.04	.04	.02	.02	-.02	.05
Ethnicity	-.70 <sup>†</sup>	.38	-1.47	.06	-.07	.33	-.73	.58
Gender	.13	.34	-.53	.79	-.06	.31	-.67	.56

Note. High analytic thinking represents Cognitive Processing Style scores above 30; low analytic thinking represents Cognitive Processing Style scores at and below 30.

<sup>a</sup>Denotes the variable was centered conceptually around 30.

<sup>®</sup>Denotes a reverse square root transformed measure.

<sup>†</sup> $p < .10$ . \* $p < .05$ .

## Discussion

### Summary

This study tested the utility of an integrated IP-DP model to explain relationships among delinquency-related factors, analytic thinking, and engagement among adolescents in substance abuse treatment. IP components, which specified that maladaptive scripts mediate the relationships between exposure to aggressive friends and delinquency-related factors,

were tested first. Results indicate greater exposure is related to greater maladaptive cognitive scripts. Greater exposure also predicts higher hostility and higher negative urgency, both directly and indirectly, through its relationship with maladaptive scripts. Exposure is independently related to greater willingness to take risks, but when maladaptive scripts are accounted for, this relationship is no longer observed (even though maladaptive scripts are unrelated to risk taking; see Figure 4). For engagement measures, results indicate that exposure is unrelated, and that maladaptive scripts is related only to treatment participation. Greater maladaptive scripts predicts lower treatment participation even after accounting for level of exposure to aggression (Figure 5). Thus, the IP model is supported for delinquency measures, but not engagement measures.

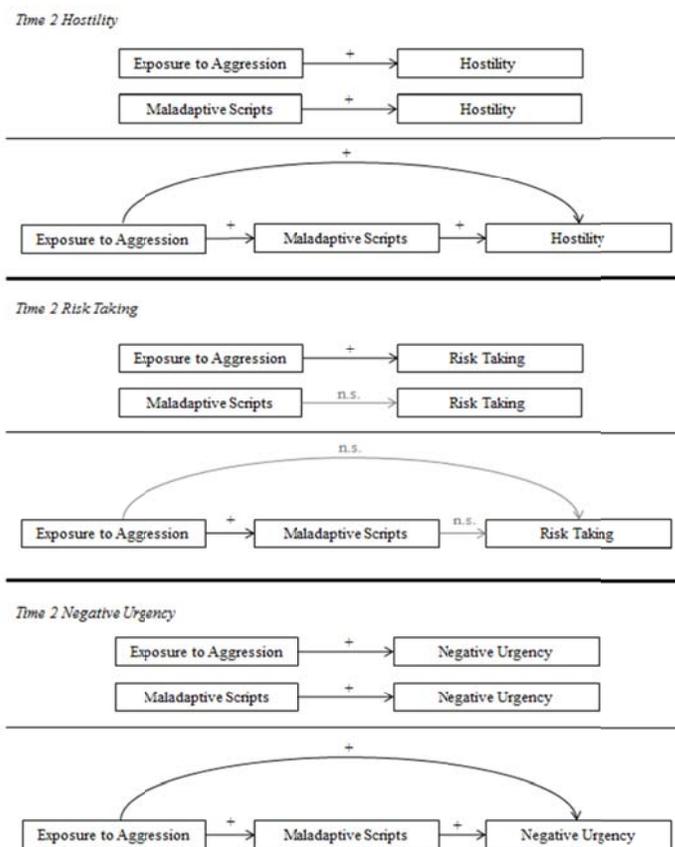
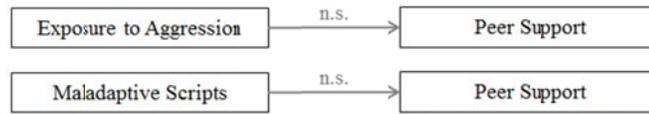


Figure 4: Hypothesis 1 Results

*Time 2 Peer Support*



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*Time 2 Treatment Participation*

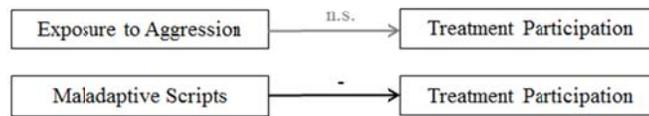


Figure 5: Hypothesis 2 Results

An integrated IP-DP model, which specified that analytic thinking reduces the relationships between IP components and dependent measures, was tested second. Findings reveal that analytic thinking predicts negative urgency, but not hostility or risk taking. Participants who utilize more analytic thinking report lower negative urgency at Time 2. Also, the effect of maladaptive scripts on treatment engagement depends on analytic thinking. Specifically, the negative relationship between maladaptive scripts and treatment participation remains significant among high analytic participants, but is no longer significant among low analytic participants. Results support the DP-only portion of the integrated model. Analytic thinking moderates the relationships between maladaptive scripts and engagement measures, but does not affect IP relationships with delinquency measures.

**Utility of the Integrated IP-DP Model**

Cognition (maladaptive scripts and analytic thinking) appears to play an important role for both delinquency and treatment measures. Results reveal multiple links between variables of interest, but are generally inconsistent with the integrated IP-DP model as a

whole. First, the IP model is partially supported for hostility and negative urgency in that maladaptive cognitive scripts partially mediates the relationships between exposure and hostility, and exposure and negative urgency, but the addition of analytic thinking (the DP component) does not appear to alter IP relationships. Second, greater maladaptive scripts reduces treatment engagement, but the larger IP model is not supported for engagement measures, thus, neither is the integrated model. Third, analytic thinking moderates relationships between maladaptive scripts and engagement measures, but it does so in the opposite direction than expected. A reduction in the relationship between maladaptive scripts and treatment participation is hypothesized to occur for highly analytic participants, but instead, occurs for low analytic participants.

The SIP assumption that cognition, rather than social cues (measured by exposure to aggressive friends), accounts for aggression variability (measured by hostility and negative urgency) is partially supported. That the IP model is not supported for risk taking is not surprising considering that hostility and negative urgency measures are more directly linked to aggression cues than the risk taking measure. Items comprising hostility and negative urgency are related to anger (“You feel you have a lot of anger inside you;” Hostility), aggression (“When I feel rejected, I will often say things that I later regret;” Negative Urgency), and acting out in response to negative emotions (“Your temper gets you into fights or other trouble;” Hostility; “I often make matters worse because I act without thinking when I am upset;” Negative Urgency). In contrast, items comprising risk taking are generally unrelated to emotions or aggression (“You like to take chances”). At least conceptually, hostility and negative urgency cues are more similar to each other than they are to risk taking cues. They are also more similar to IP factor (aggression-related) cues than risk taking. This

cue proximity or cue similarity (Hochberg & Silverstein, 1956) may explain why the IP model was not supported for risk taking. Exposure and scripts may be related indirectly to risk taking through another mediator such as negative urgency (Anestis, Anestis, & Joiner, 2009). Furthermore, the DP measure used in this study (cognitive processing style) assesses processing along a single continuum, and therefore may not provide enough discriminating information to detect variations among relationships between independent and dependent variables with high cue similarity. An instrument such as the Rational-Experiential Inventory (REI; Pacini & Epstein, 1999), which assesses processing style along two continuums using four scales (Ability and Engagement in both Rational and Experiential styles), would offer more information and may be better able to detect fluctuations.

Along similar lines, findings inconsistent with the full SIP and integrated models predicting engagement may also be related to low cue proximity. Like risk taking, items comprising engagement measures are not directly related to aggression cues (“You always participate actively in your counseling sessions;” Treatment Participation), and it may be that other factors, such as motivation for treatment, mediate the relationship between IP components and treatment engagement. Studies show that motivation factors are closely tied to engagement (Fiorentine, Nakashima, & Anglin, 1999; Hiller, Knight, Leukefeld, & Simpson, 2002; Joe, Simpson, Broome, 1999). Perhaps the benefits of higher analytic thinking anticipated by the IP-DP model occur for participants with higher motivation. For example, a treatment participant with maladaptive cognitive scripts who must choose whether or not to attend a group counseling session may weigh the pros of attending more heavily than the cons if the participant is highly motivated. In contrast, a less motivated

participant might justify skipping the session by attributing greater value to the immediate alternatives.

Despite some possible limitations (DP measure and cue proximity), results show that analytic thinking plays a role in the link between maladaptive scripts and treatment engagement. The effect of maladaptive scripts on engagement was expected to be attenuated for highly analytic participants. For these data, however, maladaptive scripts retains its impact on engagement for highly analytic participants, while losing impact for low analytic participants. These unexpected findings may reflect the effects of developmental mechanisms, such as schema development, that are proposed by the integrated IP-DP model (from the IJDM model; Dansereau, Knight, & Flynn, 2013), but not measured or tested directly in this study. For example, participants with rigid or entrenched schemas for personal behavior may engage in automatic behavioral responses, such as rejecting counselor or peer feedback outright, making them appear less responsive to intervention efforts (for more on entrenchment, see Brady, 2013; and Dane, 2010). It is likely that processing style interacts with both exposure and cognitive content to affect entrenchment, schema development, and, thus behavior. A single, static measure of cognitive scripts (like the measure used in this study) may not be sufficient for use in explanatory models. For instance, measuring the flexibility/entrenchment of schemas along with static beliefs about aggression may better represent cognitive content. Therefore, it would benefit future studies to include more comprehensive, dynamic measures of exposure, schemas, and cognitive processing.

Although these data do not provide direct support for the integrated model, results suggest that both SIP and DP components (especially cognitive factors) have explanatory

value. In addition, it appears that the findings most consistent with the models are those with the most direct links (aggression components link to aggression-related outcomes). These points, as well as the existence of other potential mediating factors and measurement limitations, suggest that model revision and further testing is needed.

### **Future Model Revisions**

As previously discussed, treatment motivation and cognitive entrenchment may be useful factors to include in future reconceptualizations of the integrated IP-DP model. Model revisions may also benefit from including thinking errors as a third potential mediator. For the purpose of this discussion, the term “thinking errors” describes patterns of reasoning (schemas) that are developmentally adaptive (e.g., taking on a victim role after being abused), but become maladaptive or harmful when used inappropriately (e.g., taking on a victim role after abusing someone else to avoid punishment; known as Victim Stance; Yochelson & Samenow, 1976). Cognitive delinquency theories suggest that thinking errors, especially criminal thinking errors, account for the initiation and perpetuation of various forms of problem behaviors. Criminal thinking errors (Walters, 1990; Yochelson & Samenow, 1976) originate from neutralization theory (Sykes & Matza, 1957), which proposes that punishment does not deter young offenders’ problem behaviors because they separate themselves from the consequences of their behaviors using thinking errors (i.e., neutralization techniques; denial of responsibility, denial of injury, denial of the victim, condemnation of the condemners, and appeal to higher loyalties). The use of thinking errors is akin to the SIP explanation of proactive aggression – that is, the decision to behave aggressively is deliberate and goal-oriented (rather than an automatic reaction) arising from a positive attitude toward aggression (Crick & Dodge, 1996). Evidence suggests that thinking

errors, such as discounting (future negative consequences are deliberately devalued; Wilson & Herrnstein, 1985), are associated with criminal activity (Nagin & Pogarsky, 2004). Perhaps, compared to low analytic participants, high analytic participants are better at creating and utilizing thinking errors. It may be useful to identify the presence of these types of schemas (such as discounting or criminal thinking errors) in future tests of the IP-DP model. Perhaps for some highly analytic youth, the use of thinking errors is analogous to the automatic maladaptive cognitive scripts for youth who are less analytical or have been heavily exposed to aggression cues.

In summary, further conceptualizations and tests of the IP-DP model should consider the roles of motivation factors and the process of schema development, specifically entrenchment and criminal thinking errors. A more complete IP-DP explanation might make the following suggestions. First, exposure and cognitive processing style affect the development and entrenchment of maladaptive schemas. Second, as a result of those effects, some youth begin treatment with maladaptive but less entrenched schemas that vary in sophistication from scripts to thinking errors, and other youth enter treatment with maladaptive and deeply entrenched schemas/scripts. Third, these schemas or scripts, along with processing style, then affect delinquency- and motivation-related factors. Fourth, schemas and scripts, interacting with cognitive style, may then also affect engagement via motivation.

### **Limitations**

This study has several limitations. First, findings are not universally applicable to all adolescents in substance abuse treatment. Data for this study were gathered from participants in community-based residential treatment facilities, but do not represent participants in

corrections-based or outpatient facilities. Data also represent only those participants who remained in treatment long enough to complete the Time 2 assessment battery. Thus, generalizability to youth in other settings or to those who leave treatment early is not implied.

Second, conclusions drawn from these findings are limited by study design. Unlike in previous longitudinal SIP studies (e.g., Burks, Laird, Dodge, Pettit, and Bates, 1999) where exposure to aggression data were collected much earlier than cognitive measures, exposure and maladaptive scripts were both measured at intake in this study. Thus, causality cannot be inferred between exposure and script measures. It is also important to note that participants continued treatment between Time 1 and Time 2 assessment completions. Although each delinquency model controls for Time 1 scores on the dependent measure, models did not control for changes in the independent measures. For example, it is unknown if high and low analytic participants become more or less similar to each other with time in treatment. In addition, the impact of treatment on study measures is unknown.

Third, potential measurement limitations should be noted. Assessments were completed via participant self-report. Though reliability coefficients were within acceptable ranges, incorporating collaborative data, such as the family and teacher evaluations used in previous SIP studies (e.g., Burks et al., 1999), can increase reliability (Connelly & Ones, 2010; Huprich, Bornstein, & Schmitt, 2011). Also, the exposure to aggression measure in this study is specific to aggressive friends; therefore, it cannot be ruled out that youth reporting low exposure to aggressive friends have been highly exposed to aggression in other contexts (e.g., family, neighborhood, etc.). It is also unknown if floor or ceiling effects were present for some youth; however, given that the distributions were normal, this may have been the case for only a limited number of participants.

Finally, there may be background characteristics that can further explain relationships explored in this study. For instance, girls often enter treatment farther along in manifesting their addiction than boys, and have experienced more trauma and abuse. Gender differences for treatment initiation have been clearly documented (Green, Polen, Dickinson, Lynch, & Bennett, 2002; Peters, Strozier, Murrin, & Kearns, 1997; Wechsberg, Craddock, & Hubbard, 2008). Although gender and ethnicity are controlled for in analyses, they are not tested as mediators or moderators. Future studies should consider exploring these potential effects.

### **Conclusion**

This study suggests that components of the integrated IP-DP model have explanatory value that warrant further exploration. Findings demonstrate that, for adolescents, beliefs endorsing aggression are related to higher hostility, negative urgency, and lower treatment participation; and the link between those beliefs and treatment participation depends on analytic thinking. Results imply that treatment for adolescents should focus on improving thinking, and that targeting maladaptive beliefs and cognitive processing may be especially salient for at-risk youth. Examining additional mediating factors, such as motivation, entrenchment, and thinking errors could shed further light on delinquency and the treatment process for youth.

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## Appendix

### Scoring Guide for Measures of Interest

**Scoring Instructions.** Numbers for each item indicate its location in the administration version, and response categories are (1) disagree strongly, (2) disagree, (3) uncertain, (4) agree, and (5) agree strongly. Scores for each scale are obtained by summing responses to its set of items after reversing scores on reflected items (i.e., designated with ®) by subtracting the item response from “6”, dividing the sum of each scale by number of items included (yielding an average), and multiplying by 10 in order to rescale final scores so they range from 10 to 50 (e.g., an average response of 2.6 for a scale becomes a score of “26”).

**Exposure to Aggressive Friends (ETVF; 4 Items from the Peer Trouble Scale; TCU ADOL FFS FORM)**

10. You have friends who have damaged other people’s property.
12. Your friends do things that can get them into trouble with the law.
30. You have friends who are in gangs of some type.
35. You have friends who have used a weapon (gun, knife, or club) in a fight.

**Maladaptive Cognitive Scripts (SRDEF; 4 Items from the Power Orientation Scale; TCU ADOL HVCT FORM)\***

20. The only way to protect yourself is to be ready to fight.
24. When people tell you what to do, you become aggressive.
28. You think you have to pay back people who mess with you.
34. If someone disrespects you then you have to straighten them out, even if you have to get physical.

**Cognitive Processing Style (Continuous; CPS; 6 Items from the Premeditation Scale; TCU ADOL THKA FORM; 3 Items from the Decision Making Scale; TCU ADOL PSYFORM)**

**From Premeditation:**

- 2. Before making up my mind, I consider the advantages and disadvantages.
- 5. I am a cautious person.
- 8. I tend to follow a rational, "sensible" approach to things.
- 12. I usually think carefully before doing most things.
- 21. I like to stop and think things over before I do them.
- 32. I usually make up my mind through careful thinking.

**From Decision Making:**

- 4. You plan ahead.
- 26. You make decisions without thinking about consequences. ®
- 33. You examine problems by looking at all the choices.

**Hostility (HSY; TCU ADOL SOCFORM)**

- 8. You have carried weapons, like knives or guns.
- 10. You feel a lot of anger inside you.
- 12. You have a hot temper.
- 13. You like others to feel afraid of you.
- 15. You feel mistreated by other people.
- 24. You get mad at other people easily.
- 28. You have urges to fight or hurt others.
- 36. Your temper gets you into fights or other trouble.

**Risk Taking (RTY; TCU ADOL SOCFORM)**

- 3. You only do things that feel safe. ®
- 16. You avoid anything dangerous. ®
- 18. You are very careful and cautious. ®
- 26. You like to do things that are strange or exciting.
- 30. You like to take chances.
- 33. You like the “fast” life.
- 34. You like friends who are wild.

**Negative Urgency (NUY; TCU ADOL THKFORM A)**

- 4. When I am upset I often act without thinking.
- 7. When I feel rejected, I will often say things that I later regret.
- 10. It is hard for me to resist acting on my feelings.
- 19. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.
- 25. I often make matters worse because I act without thinking when I am upset.
- 27. In the heat of an argument, I will often say things that I later regret.

**Treatment Participation (TPY; TCU ADOL ENGFORM)**

- 6. You are willing to talk about your feelings during counseling.
- 9. You have made progress with your drug/alcohol problems.
- 11. You have learned to analyze and plan ways to solve your problems.
- 12. You have made progress toward your treatment program goals.
- 13. You always attend the counseling sessions scheduled for you.
- 20. You have stopped your drug use while in this program.

- 22. You always participate actively in your counseling sessions.
- 23. You have made progress in understanding your feelings and behavior.
- 25. You have improved your relations with other people because of this treatment.
- 28. You have made progress with your emotional or psychological issues.
- 31. You give honest feedback during counseling.
- 36. Other clients at this program make it hard for you to focus on your treatment. ®

**Peer Support (PSY; TCU ADOL ENIFORM)**

- 19. Other clients at this program care about you and your problems.
- 24. Other clients at this program are helpful to you.
- 27. You are similar to (or like) other clients of this program.
- 30. You have developed positive trusting friendships while in this program.
- 33. There is a sense of family (or community) in this program.
- 35. Your friendships at this program have gotten you in trouble with the staff. ®

**Social Desirability Scale (SDY; TCU ADOL SOCFORM)\*\***

- 2. You have never deliberately said something that hurt someone's feelings.
- 4. You are sometimes irritated by people who ask favors of you.
- 7. When you do not know something, you do not at all mind admitting it.
- 11. You sometimes try to get even rather than forgive and forget.
- 14. You are always willing to admit it when you make a mistake.
- 19. There have been times when you took advantage of someone.
- 22. You can remember "playing sick" to get out of something.
- 23. No matter who you are talking to, you are always a good listener.
- 27. You have felt like rebelling against people in authority even when they were right.

32. Occasionally, you give up doing something because you thought too little of your ability.

35. You sometimes get mad when you do not get your way.

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\*Four items from the Power Orientation Scale; Revised “Psychological Inventory of Criminal Thinking Styles (PICTS)” scale, taken from Walters, G. D. (1998). [Changing lives of crime and drugs: Intervening with substance abusing offenders. New York: John Wiley & Sons.]

\*\*Revised “Marlowe-Crowne Social Desirability (MCSD)”, taken from D. P. Crowne, & D. Marlowe (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, 24, 349-354.

\*\*Note. Special scoring for “Social Desirability”: Items 2, 7, 14, 23 are scored 1=Agree Strongly or Agree and 0=Uncertain, Disagree or Strongly Disagree. Items 4, 11, 19, 22, 27, 32, 35 are scored 1=Disagree Strongly or Disagree, and 0=Uncertain, Agree or Strongly Agree. All of the items in the scale are then summed to get the Social Desirability score. Higher scores on this index tend to indicate questionable results for the entire questionnaire.

## VITA

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## ABSTRACT

### THE EFFECT OF ANALYTIC THINKING ON DELINQUENCY-RELATED FACTORS AND TREATMENT ENGAGEMENT AMONG ADOLESCENTS

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This study aimed to propose and test an integrated model of information processing and dual-processing components (IP-DP model) to explain connections among delinquency-related factors and treatment engagement. Hypotheses stated that exposure to aggressive friends would be associated with maladaptive cognitive scripts, and maladaptive scripts would mediate relationships between exposure and delinquency, and exposure and engagement. Analytic thinking was expected to moderate these relationships by attenuating the negative effects of exposure and maladaptive scripts on outcome measures. Data were collected from 424 adolescents in 8 community-based residential treatment facilities as a part of the TCU Adolescent Project. Hypotheses were tested using PROC MIANALYZE to conduct multiple regression across 5 imputed datasets. Results indicated that maladaptive scripts partially mediate the relationships between exposure and hostility, and exposure and negative urgency. Analytic thinking moderates the relationships between maladaptive scripts and engagement. Findings were not supportive of the IP-DP model but suggest further testing.