Antisocial Behavior:
Roles of Self-Serving Cognitive Distortions and Ventromedial Prefrontal Function

THESIS

Presented in Partial Fulfillment of the Requirements for the Degree Master of Arts in the Graduate School of The Ohio State University

By

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2012

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Abstract

Current research has made significant strides on two levels of analysis pertaining to cognitive and neurobiological processes associated with antisocial behavior. At the cognitive level, pervasive use of Self-Serving Cognitive Distortions (SSCDs) has been emphasized in the facilitation/perpetuation of antisocial behavior. At the neurobiological level, the ventromedial prefrontal cortex (vmPFC) has been identified as the core of a neural network associated with behavioral decision-making. While studies have linked these processes individually to antisocial behavior, researchers have yet to examine their relative contributions and relationships to one another. The present study addresses this shortcoming with exploratory research of the roles of SSCDs and vmPFC function in accounting for antisocial behavior. Participants (N = 116) completed self-report measures of SSCDs, antisocial behavior, internalizing behavior, aggression, and empathy. Additionally, participants completed two neurological proxy tasks pertaining to vmPFC and dorsolateral prefrontal function. SSCDs correlated with antisocial behavior, even when controlled for internalizing behavior; both correlated inversely with empathy. VmPFC function did not correlate with antisocial behavior or with SSCDs. The results of the study do not suggest that the vmPFC serves as a neural correlate of SSCDs. Additional research is needed to establish the specific role of vmPFC function in antisocial behavior.
Dedicated to…

…My wife, Meghan, for being my support and holding my hand through all of life’s challenges

…My parents for all the sacrifices that they’ve made so that I may pursue my dreams
Acknowledgments

I would like to thank my advisor, Dr. John Gibbs, for his guidance and countless thoughtful suggestions throughout the course of this master’s project. Most importantly, I want to express my sincere gratitude for the time he has sacrificed serving as my mentor and aiding in my professional development.

I would also like to extend my appreciation to my committee members, Dr. Susan Johnson and Dr. Raymond Montemayor, for their support and helpful feedback on this project. Furthermore, I would like to thank Dr. Phil Allen for his assistance in the conceptualization and operationalization of this project.

I am extremely grateful to my research assistants, Patrick Bortz and Drishti Pillai, for the countless hours they spent dedicated to this study. I admire their work ethic as well as their enthusiasm for scientific research.

Finally, I would like to thank my close friends and family. They provide me with encouragement, offer sincere advice, and are always willing to lend a helping hand. I am indebted to each and every one of you.
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Chapter 1: Introduction

Antisocial behavior, pertaining to wrongful acts that harm others, is a pervasive and complex phenomenon that requires multiple levels of analysis. Indeed, researchers have identified numerous cognitive, biological and sociocultural processes that are associated with antisocial behavior. Current research has made significant strides in two levels of analysis pertaining to cognitive and neurobiological processes. At the cognitive level, the role of self-serving cognitive distortions (e.g., “You have to get even with people who don’t show you respect;” Gibbs, Barriga, & Potter, 2001) has been emphasized in accounting for antisocial behavior. Pervasive use of these “thinking errors” has been associated with elevated levels of antisocial behavior and reduced empathy (Gibbs, 2010). At the neurobiological level, researchers have investigated a cortical network associated with antisocial behavior. Studies have identified the ventromedial prefrontal cortex (vmPFC) as the core of this neural network (Mendez, 2009). The vmPFC has been implicated in: the inhibition of antisocial tendencies; regulating emotions and incorporating them into decision-making; and empathic ability. While studies have linked these processes individually to antisocial behavior, researchers have yet to examine their relative contributions and interrelationships to one another. Exploring these relationships is imperative to furthering our understanding of antisocial behavior and its etiology.
This chapter is divided into three sections, with the ultimate goal of providing the rationale for an exploratory study of SSCDs, vmPFC function, and antisocial behavior. In the first two sections, literature is reviewed that supports the individual relationships of SSCDs and vmPFC functioning with antisocial behavior. Finally, the third section links these two literatures and outlines the objectives of the present study.

*Self-Serving Cognitive Distortion and Antisocial Behavior*

One aim of research concerning antisocial behavior has been to identify associated cognitive processes. Researchers have investigated how thinking patterns influence a variety of adjustment and behavioral outcomes. Evidence from this literature suggests that antisocial tendencies are due, at least in part, to pervasive self-exculpatory cognitive distortions. While there are various types of cognitive distortions, those that facilitate antisocial behavior are commonly referred to as self-serving cognitive distortions (SSCDs). SSCDs pertain specifically to inaccurate frameworks for interpreting situations or explaining one’s antisocial behavior (Gibbs, 2010). These biased processing tendencies may initiate and perpetuate antisocial tendencies (cf. Dodge, Coie, & Lynam, 2006).

At elevated levels, SSCDs may disinhibit aggression and maintain an individual’s positive self-concept despite chronic offending behavior. According to Barriga and colleagues (Landau, Stinson, Liau, & Gibbs, 2000), “Externalizing individuals’ cognitive distortions are criminogenic insofar as they help protect the self from blame or a negative self-concept and disinhibit aggression or other antisocial behavior” (p. 38). The
psychological stress caused during (or after) the commission of a deviant act conflicts with the antisocial individual’s belief that he is genuinely a good person. In an effort to reconcile this contradiction and reduce empathy-based guilt, the individual uses SSCDs to minimize/displace responsibility and blame (including self-blame) for his actions. As one 17-year-old delinquent, looking back on his burglaries and victims, explained: “If I started feeling bad, I’d say to myself, ‘tough rocks for him. He should have had his house locked better and the alarm on’” (Samenow, 1984, p. 115). The use of SSCDs to dissociate one’s self-concept of conscience from one’s actions may create a negative cycle that perpetuates antisocial behavior. Sharp (200) suggested that “Criminal behavior is the result of erroneous thinking. Criminals’ thinking leads to their feelings, their feelings lead to their behavior, and their behavior reaffirms their thinking” (p. 2).

Self-exculpatory cognitive processes have been examined in several theoretical accounts of antisocial behavior. Sykes and Matza (1957) proposed that antisocial individuals rationalize their behavior through the use of neutralization techniques. Contrary to popular belief at the time, they held that antisocial individuals are generally aware of their moral obligation to society, and feel at least somewhat committed to this obligation. Prior to engaging in antisocial behavior, they argued, an individual has to make an exception for his actions. Through observation, Sykes and Matza delineated five neutralization techniques: (1) denial of responsibility, (2) denial of injury, (3) denial of the victim, (4) condemnation of the condemners, and (5) appeal to higher loyalties. These techniques function to diminish feelings of moral obligation and provide valid justifications (at least in the offender’s mind) for antisocial acts.
Yochelson and Samenow (1976) theorized that the thinking patterns of offenders were qualitatively different from those of responsible members of society, and that all criminals are fundamentally similar in the way they think. From 17 years of clinical work and over 255 in-depth observations of patients and their families, Yochelson and Samenow identified 52 thinking errors (Yochelson & Samenow, 1976) associated with antisocial behavior. While all individuals occasionally commit these thinking errors, only the criminal uses them in a frequent and pervasive fashion (Harris, 1984).

Such cognitive processes have also been examined in more recent theoretical work. Social information processing theory (SIP) (Dodge & Rabiner, 2004; Crick & Dodge, 1994) outlined six steps that are necessary for individuals to process social cues and form an appropriate behavioral response. According to SIP, in a social interaction an individual: (1) encodes external and internal cues, (2) interprets and creates a mental representation of those cues, (3) clarifies or selects of a goal, (4) accesses or constructs a response, (5) determines a response decision, and (6) enacts response decision/behavior (Crick & Dodge, 1994). In this model, SSCDs are represented as biased processing tendencies, such as ignoring relevant social cues, attributing hostile intentions to others, and evaluating aggressive behavioral responses positively. Crick and Dodge argue that biased processing tendencies are schema-based (i.e., derive from latent knowledge structures) and can occur at any step in SIP and lead individuals to enact socially maladaptive, and often aggressive, behavioral responses. Research has shown consistent, albeit modest, correlations between deviant modes of social information processing and
antisocial behavior (Dodge, 1986; Dodge, Bates, & Pettit, 1990; Steinberg & Dodge, 1983).

In social cognitive learning theory, Bandura and colleagues have operationalized SSCDs as *methods of moral disengagement* (Bandura, 1991; Bandura, Barbaranelli, Daprara, & Pastorelli, 1996). According to this theoretical account, individuals engaged in antisocial behavior must use strategies to disengage detrimental conduct from self-evaluation, i.e., reconstrue moral/ethical standards as inapplicable to his antisocial behavior. In order to morally disengage, Bandura and colleagues (Bandura et al., 1996) argued, individuals use the following techniques: (1) displacement of responsibility, (2) diffusion of responsibility, (3) distorting the consequences of an action, (4) dehumanizing the victim, and (5) assuming the role of the victim for one’s self. Since the individual deems his actions as morally acceptable, antisocial behavior is disinhibited.

Although individual findings vary, the literature generally suggests a substantial relationship between mechanisms of moral disengagement and antisocial behavior (Bandura, 1999; Bandura, Caprara, & Zsolnai, 2000; Hyde, Shaw & Moilanen, 2009).

Organizing the extant literature on cognitive distortions, Gibbs and Potter (1993) introduced a theoretically clear and empirically grounded delineation of self-serving cognitive distortions. Gibbs’ and Potter’s typology of self-serving cognitive distortions consists of four correlated, yet distinct, categories:

1. **Self-Centered**: according to one’s own views, expectations, needs, rights, immediate feelings, and desires to such an extent that the legitimate views and of
forth of others (or even one’s own long-term best interest) are scarcely considered or are disregarded altogether.

2. Blaming Others: misattributing blame for one’s harmful actions to outside sources, especially to another person, group, or momentary aberration (one was drunk, high, in a bad mood, etc.); or misattributing blame for one’s victimization or other misfortune to innocent others.

3. Minimizing/Mislabeling: depicting antisocial behavior as causing no real harm or as being acceptable or even admirable, or referring to others with belittling or dehumanizing labels.

4. Assuming the Worst: gratuitously attributing hostile intentions to others, considering a worst-case scenario for a social situation as if it were inevitable, or assuming that improvement is impossible in one’s own or others’ behavior.

These categories are grouped, based on function, into two main subtypes; (1) Primary, and (2) Secondary. The primary SSCD (Self-Centered) is the result of pronounced egocentric bias that persists into adolescence and adulthood. According to Gibbs (2010),

In the absence of moral judgment perspective-taking opportunities, the self-centration (including “I want it now” temporal centration) characteristic of early childhood can evolve in later years into a network of self-skewed schemas that guides one’s perception and explanation of events and indeed one’s basic approach to life, one’s worldview (132).

The primary distortion supports egoistic motives and hence the individual’s satisfaction of his needs or desires at the expense of others. As noted, however, antisocial acts may
generate psychological stresses (dissonance with self-concept, empathy-based guilt). The secondary cognitive distortions (Blaming Others, Minimizing/Mislabeling, and Assuming the Worst) are theorized to function as a coping mechanism, allowing the individual to deal with the psychological stress associated with offending and carry out the antisocial act.

To assess the use of both primary and secondary SSCDs in antisocial behavior, the *How I Think (HIT)* questionnaire was developed (Barriga & Gibbs, 1996; Gibbs, Barriga, & Potter, 2001). Constructed using Gibbs et al.’s (1995) four-category typology of SSCDs, the HIT questionnaire assesses overall levels of SSCDs. In the initial validation study (Barriga & Gibbs, 1996), score on the HIT questionnaire correlated highly with self-reported measures of antisocial behavior. In regression analysis, SSCDs (HIT score) accounted for 30% of the variance in self-reported antisocial behavior. Additionally, the HIT questionnaire successfully distinguished antisocial individuals (e.g., adjudicated offenders) from control groups. These results not only validated the HIT questionnaire, but also provided evidence for the association between the pervasive use of SSCDs and antisocial behavior.

The Gibbs typology and HIT questionnaire have led to several lines of research investigating the relationship between SSCDs and antisocial behavior. Barriga et al. (2000) evaluated cognitive distortions and problem behaviors in delinquent and non-delinquent adolescents. Confirming the results of the HIT validation study, Barriga and colleagues found that antisocial adolescents experienced significantly higher levels of SSCDs compared to their non-delinquent peers. The study also provided support for the
specificity of SSCDs to externalizing behaviors. Consistent with theory, self-serving cognitive distortions (but not self-debasing, i.e., depressogenic thoughts) predicted a significant proportion of variance in self-reported antisocial behavior. This evidence provided empirical support for the theoretical distinction between self-serving (linked to externalizing behavior) and self-debasing (linked to internalizing disorders) distortions.

In a later study, Barriga, Hawkins, and Camelia (2008; cf. Liau, Barriga, & Gibbs, 1998) investigated the cognitive-behavioral specificity of SSCDs within the externalizing domain. They found that SSCD items with overt behavioral referents (e.g., fighting) were correlated with reported aggressive behavior, and those with covert referents (e.g., stealing) were correlated to non-aggressive delinquent behavior. These studies suggest that the predictive capabilities of self-serving cognitive distortions are specific to the externalizing domain and, within that domain, different types of distortions may be capable of predicting specific types of behavior.

Other studies have linked SSCDs to indices of antisocial behavior. McCrady and colleagues (McCrady et al., 2008) investigated both sex-specific and general cognitive distortions in 175 adolescent sex offenders. Juvenile sex offenders evidenced clinically elevated levels of both generic and sex-specific distortions. Furthermore, generic and sex-specific distortions were related. Another study, conducted by Capuano (2011), provides support for the predictive capabilities of SSCDs in specific categories of aggressive behavior in adolescents. Specifically, Capuano investigated the relationship between SSCDs and severe, moderate, and physical aggression. A series of regression analyses revealed that SSCDs are not only associated with severe and moderate physical
aggression in adolescents, but also social aggression. These studies suggest that elevated levels of SSCD perpetuate a wide variety of antisocial behaviors.

Consistent with theoretical suggestions that SSCDs facilitate antisocial behavior at least in part by neutralizing empathy for others have been findings indicating a correlation between these variables. Barriga, Sullivan-Cosettie, and Gibbs (2009) found that extensive endorsement of SSCDs was associated with lower empathy (both cognitive and affective). It is important to note that, while the neutralizing function of SSCDs may initially be situational (i.e., reduce empathic distress for/from a particular deviant act), it is theorized to become habitual and generalized over time (i.e., a cognitive scheme) (Barriga et al., 2009).

An enduring limitation of the extant literature concerns the temporal relationship between SSCDs and antisocial behavior. As Maruna and Mann (2006) point out, it is unclear when SSCDs occur in the chronology of offending. That is, do SSCDs precede or follow antisocial behavior? Theoretical accounts of SSCDs differ in how they conceptualize this relationship. For instance, neutralization theory, social information processing theory, and moral disengagement theory all posit that SSCDs precede (or occur during) antisocial behavior. For example, Bandura and colleagues (Bandura et al. 1996) state, “People do not ordinarily engage in reprehensible conduct until they have justified to themselves the rightness of their actions” (365). This implies that SSCDs are involved in the decision-making process and have a proximal causal relationship with antisocial behavior. According to this theoretical view, SSCDs facilitate, or disinhibit, antisocial behavior. In a longitudinal study of young children, Dodge, Bates, and Pettit
(1990) found that distorted social information processing did precede and correlate with subsequent antisocial behavior in kindergarten.

Gibbs and colleagues suggest the possibility of multidirectional causality, i.e., that SSCDs may precede and/or follow antisocial behavior. According to Barriga and Gibbs (1996), the secondary SSCDs represent “pre-or-post transgression rationalizations that neutralize conscience or guilt” (p 334). Insofar as they may precede antisocial behavior, SSCDs facilitate antisocial behavior by neutralizing one’s conscience. Insofar as they may serve as post-transgression rationalizations, SSCDs serve a maintenance function. Although an influential relationship between SSCDs and antisocial behavior is evident, the causal direction of the relationship remains ambiguous. Until a causal relationship is established, one must be cautious when interpreting the role of SSCDs in their relationship with antisocial behavior.

**Ventromedial Prefrontal Function and Antisocial Behavior**

At the neurobiological level of analysis, researchers in the area of moral cognitive neuroscience have examined the relations between cortical functioning and antisocial behavior. Recent advances in brain imaging technology (e.g., fMRI) have led to the identification of a network of cortical regions associated with prosocial/antisocial behavior. At the core of this neural network is the ventromedial prefrontal cortex (vmPFC). According to Mendez (2005), “The vmPFC attaches moral and emotional value to social events, anticipates their future outcomes, and participates in ToM [Theory of Mind], empathy, attribution of intention, and related tasks” (p. 609). When functioning
properly, processes occurring in the vmPFC incorporate emotion and social evaluations into decision-making and play a critical role in the regulation of antisocial behavior.

Damage or attenuated functioning of the vmPFC results in increased impulsivity/reactivity, irrational decision-making, perspective-taking and empathy deficits, and increased antisocial behavior. One of the pioneering studies implicating the vmPFC as a neural correlate of antisocial behavior used structural MRI technology to localize and investigate the damage in cortical regions of a famous brain lesion patient (Damasio, Grabowski, Frank, Galaburda, and Damasio, 1994). The patient, known as Phineas Gage, was a construction foreman who suffered a severe injury while at a job site. While momentarily distracted, Gage accidentally struck black powder with a tamping iron. This resulted in an explosion that sent the iron rod through Gage’s face, skull, and brain. Remarkably, Gage survived and most of his cognitive abilities were fully intact. However, the brain lesion caused profound personality changes. Once considered a respectable, even-keeled individual, Gage’s injury left him irrational and morally reprehensible.

In their reconstruction of his injury, Damasio and colleagues were able to localize the damage to the right and left vmPFC. Other regions of the prefrontal cortex, such as the dorsolateral PFC, were intact. Damasio and colleagues compared Gage’s alleged behavior to 18 other individuals with similar brain lesion patterns. The patients all evidenced behavior similar to that of Gage: their ability to process and deploy rational social decisions was compromised, but their ability to solve cognitive problems was intact. According to Damasio et al. (1994),
The establishment of such a pattern has led to the hypothesis that emotion and its underlying neural machinery participate in decision-making within the social domain and has raised the possibility that the participation depends on the ventromedial prefrontal region. (1104)

Consequently, the inability to appropriately process and incorporate emotion into social decision-making results in irrational, and often antisocial, behavior.

A large scale lesion study (Grafman et al., 1994) corroborated Damasio’s findings and provided direct support for its role in inhibiting antisocial behavior. In the study, Grafman and colleagues conducted a localized lesion analysis of 279 Vietnam War veterans who had suffered frontal lobe injuries during their tour of duty. Using images obtained by CT scan, the researchers were able to identify specific regions of damage within the frontal lobe. In addition to the scans, they obtained several measures of violent and aggressive behavior: Self-report, family-report, and direct observation.

The study produced two significant results. First, when compared to normal controls, individuals with frontal lesions evidenced higher levels of violence and aggression. This is expected, since the frontal lobe is associated with quality of decision-making (e.g. emotional components, executive functioning, effortful control). Second, within the frontal lesion group, those individuals with focal ventromedial lesions evidenced significantly higher levels of violence/aggression as compared to all other frontal lesion groups. This second finding supports the conclusion that the ventromedial PFC is distinct from other frontal regions in its function to inhibit aggressive behavior. Like Damasio et al. (1994), Grafman and colleagues suggest that the increase in
antisocial behavior of vmPFC lesion patients is the result of impairments in emotion regulation, perspective taking, and social attributions. Since these pioneering studies, many researchers have studied vmPFC lesions in relation to antisocial behavior and have come to similar conclusions (c.f. Bechara, Tranel, & Damasio, 2002).

In addition to lesion studies, research concerning neural correlates of psychopathy has provided evidence for the role of vmPFC function in antisocial tendencies. Psychopathy is “a developmental disorder that involves emotional dysfunction, characterized by reduced guilt, empathy and attachment to significant others, and antisocial behavior including impulsivity and poor behavioral control” (Blair, 2007, p. 387). As the definition suggests, several deficits evidenced by individuals with psychopathic traits mirror those of individuals with focal vmPFC lesions. Thus, researchers have examined whether individuals with psychopathic traits showed attenuated functioning in the vmPFC.

Marsh and colleagues (Marsh et al., 2008), investigated differences in functional connectivity between the amygdala and vmPFC in a fearful expression processing task. The study compared activation in children with high psychopathic traits to non-clinical comparison groups. As compared to non-clinical comparison groups, children with psychopathic traits showed reduced functional connectivity between the amygdala and the vmPFC. Other studies have shown that individuals with psychopathic traits have abnormal vmPFC activation during aversive learning (Birbaumer et al., 2005), reversal learning tasks (Finger et al. 2008), and affect recognition tasks (Gordon, Baird, & End, 2004). Cumulatively, these studies indicate that individuals with intact but compromised
vmPFC’s evidence elevated levels of antisocial behavior, although the causal direction is unclear.

The literature discussed thus far has provided evidence for the relationship between vmPFC function and antisocial behavior in clinical samples. Do individual differences in vmPFC function also predict antisocial tendencies in mainstream populations? Most individuals committing antisocial acts are not primary psychopaths and certainly do not suffer from a localized vmPFC lesion. Hence it is imperative to investigate whether the non-psychopathic antisocial individual exhibits deficits in vmPFC function. Relatively few studies have investigated this relationship.

At least two experiments have suggested a link between vmPFC function and antisocial behavior in a non-clinical sample. Hooper, Luciana, Wahlstrom, Conklin, and Yarger (2008) found both personality and behavioral correlates of vmPFC function in adolescents. Adolescent participants completed a proxy measure of vmPFC function (i.e., the Iowa Gambling Task), as well as a personality questionnaire. Parents reported on participants externalizing behavior using the Achenbach Child Behavior Checklist. Hooper and colleagues found that self-reported neuroticism correlated with performance on the Iowa Gambling Task. In regression analysis, externalizing behavior interacted with extraversion and neuroticism to predict performance on the Iowa Gambling Task. These results suggest that vmPFC function is associated with individual differences in personality characteristics and levels of antisocial behavior.

Strenziok and colleagues (2011) conducted an fMRI study to investigate vmPFC function during imagined aggressive and non-aggressive interactions. The results
indicated that the higher an adolescent’s score on self-reported trait anger, the lower his
vmPFC activation during the imagined aggressive behavior. Strenziok and colleagues
argue that the individuals with higher trait anger have reduced functioning may disinhibit
aggressive impulses. Although the evidence is inconclusive and largely correlational,
these studies suggest that the vmPFC may have a role in facilitating antisocial behavior in
non-clinical in addition to clinical populations.

It is clear from the literature that processes occurring in the vmPFC play an
integral role in regulating and incorporating social information into decision-making.
Psychopaths and individuals with focal vmPFC lesions show deficits in these areas and
have an increased propensity for antisocial behavior. Hence, we know that the vmPFC
plays a functional role in inhibiting aggressive and other antisocial impulses. However, it
is less clear whether vmPFC deficits are related to antisocial behavior in non-clinical
populations. The limited research in this area suggests that a relationship may exist, but
the causal directionality of that relationship remains ambiguous.

Rationale and Present Study

The reviewed literature provides evidence supporting the role of both cognitive
and neurobiological levels of processing in predicting antisocial behavior. At the
cognitive level, research suggests that pervasive use of SSCDs is associated with
antisocial behavior. SSCDs have been shown to be specific to externalizing disorders,
and to account for significant variance in a wide variety of antisocial behaviors. SSCDs
may disinhibit antisocial behavior through the reduction of psychological stress
associated with offending. At the neurobiological level of analysis, a growing body of literature suggests that the ventromedial prefrontal cortex function plays a central role in understanding/evaluating social information and inhibiting antisocial tendencies. Indeed, individuals with vmPFC lesions or dysfunction report increased levels of aggression and other antisocial behavior.

For the most part, the advances made in these two areas have occurred in isolation from one another. Although many studies have related one or another of these levels to antisocial behavior, to the best of our knowledge none have included both and examined their interrelationships. Dodge and Schwartz (1997) suggested that cognitive processes may play a key role in the influence of biological processes on social behavior. For example, the influence of vmPFC function on antisocial behavior may be mediated by SSCDs. The reviewed literature suggests several similarities in the relationships of SSCDs and vmPFC function with antisocial behavior. Both levels may relate not only to antisocial behavior, but also to deficiencies in perspective taking, reduced empathy, and biased processing of social information.

Recent findings on callous-unemotional (CU) traits are consistent with an inverse relation between vmPFC function and SSCDs. CU traits refer to reduced feelings of guilt, attenuated empathy, and callous use of others for one’s own gain (Frick & White, 2008). CU traits are one of the three primary dimensions of psychopathy and have been consistently linked to abnormal vmPFC function, as well as antisocial behavior (Finger et al. 2008). A recent study suggested that CU traits interact with SSCDs in predicting variance in delinquent behavior (Chabrol, van Leeuwen, Rodgers, & Gibbs, 2011).
Specifically, SSCDs had a higher impact on delinquent behavior in individuals with high CU traits as compared to those with low CU traits. Shulman and colleagues (Shulman, Cauffman, Piquero, & Fagan, 2011) found high correlations between CU traits and moral disengagement. That is, individuals with elevated CU traits were more likely to endorse moral disengagement techniques (aka SSCDs). The relationships of CU traits to both SSCDs and vmPFC function encourages investigation as to whether the vmPFC is a functional neural correlate of SSCDs.

Despite the relational similarities and preliminary evidence mentioned above, there is a lack of research aimed at examining the relationships across SSCDs, vmPFC functioning, and antisocial behavior. Interrelating the processes associated with antisocial behavior is necessary in order to establish a comprehensive understanding of its etiology. In this study, we aim to begin addressing this gap in the literature. Indeed, the reviewed literature supports an exploratory analysis of potential relationships between SSCDs, vmPFC function, and their respective roles in relation to antisocial behavior.

Investigating whether/how vmPFC functioning and SSCDs interact can benefit both science and society. At the most basic level, this information would enhance our understanding of how atypical cortical maturation influences antisocial behavior. Additionally, accounting for these relationships would enhance current models of antisocial behavior; increasing their predictive capability. At an applied level, interrelating these processes may influence programs for at-risk youth and adolescents. For example, if vmPFC functioning is associated with endorsement of SSCDs, then
programs aimed at reducing SSCDs should be evaluated as to whether or not they improve or compensate for vmPFC deficits.

The present study explored relationships between SSCDs, vmPFC functioning and various types of antisocial behavior in a mainstream sample. Specifically, we sought to investigate a potential relationship between SSCDs and vmPFC function as predictors of antisocial behavior. To that end, this study had two primary and two secondary exploratory aims.

Primary aims:

1. **To investigate the individual relationships of SSCDs and vmPFC function to antisocial behavior.**

2. **To explore the relationship between vmPFC function and SSCD.**

Secondary aims:

1. **To examine the relationships of vmPFC function and SSCD to empathy.** In the extant literature, both vmPFC function and SSCDs have exhibited relationships to self-reported empathy. In the present study, we aim to extend previous findings by exploring the relationships of these two processes not only to overall empathy, but also to cognitive and affective components of empathy.

2. **Explore the relationships of vmPFC function and SSCD to subtypes of aggression.** Research suggests that proactive and reactive aggression have different etiologies (see Raine et al., 2006). Thus, variables associated with antisocial behavior may differentially relate to subtypes of aggression. Therefore,
vmPFC function and SSCDs were compared to self-reported reactive and proactive aggression.
Chapter 2: Method

The methods used in this study pertain to characteristics of the participant sample, research design, the measures, and the procedure including data analyses.

Participants

Participants (N= 116, mean age = 19.65, 56 female) were recruited from the Psychology Research Experience Program (REP) at The Ohio State University. Additionally, 15 participants were tested but excluded due to anomalous responding (AR Score > 4.25) on the HIT questionnaire (see explanation under “Measures”). Participants were awarded course credit for their participation in the experiment. Participants with a history serious head injury or concussion were excluded from data collection.

All 116 participants completed the How I Think Questionnaire, Interpersonal Reactivity Index, Adult Self Report, PEBL Gambling Task, and Automated Operation Span. Forty-three of the participants also completed the Reactive-Proactive Aggression questionnaire.

Design

The current study is correlational by design. Participants completed a series of self-report measures to assess self-serving cognitive distortions, antisocial behavior,
internalizing behavior (a behavioral control variable) and empathy. In addition, participants completed neuropsychological proxy measures (i.e., computerized cognitive tasks) of ventromedial prefrontal function and dorsolateral prefrontal function (a neurological control variable).

**Measures**

The questionnaire measures used in the present study operationalized SSCDs, empathy, antisocial behavior, and internalized behavior. Scores on two neuropsychological tasks served as proxy measures for vmPFC function and dorsolateral prefrontal function.

**Self-Report Questionnaire Measures:**

**Self-Serving Cognitive Distortion.** Participants completed the How I think Questionnaire (HIT) (Gibbs, Barriga, & Potter, 2001), a paper-and-pencil measure of self-serving cognitive distortions (see Appendix A). The HIT is based on Gibbs, Potter, and Goldstein’s (1995) four category typology of self-serving cognitive distortion: Self-centered, blaming others, assuming the worst, and minimizing/mislabeling. It is comprised of 54 items scored along a 6-point Likert scale from “agree strongly” to “disagree strongly.” Of the 54 items, there are 39 items pertaining to self-serving cognitive distortion, 8 anomalous responding items (social desirability), and 7 positive fillers. Each of the 39 self-serving cognitive distortion items pertains to one of the following categories of antisocial behavior: physical aggression, opposition-defiance, lying, and stealing. This creates a 4 x 4 matrix design of cognitive distortion by
behavioral referent. The mean response to the 39 items is the Overall HIT Score. The measure also provides subscale scores: Self-Centered, Blaming Others, Minimizing-Mislabeling, Assuming the Worst, Oppositional Defiant, Physical Aggression, Lying, Stealing, Overt Referential Distortions, and Covert Referential Distortions. The 8 anomalous responding items are used to identify participants answering in a socially desirable manner. Participants scoring greater than a 4.25 on the anomalous responding scale are excluded from analysis. This helps to reduce response bias associated with self-report questionnaires. Overall, the HIT has shown good test-retest reliability ($r = .91$), internal consistency (alpha ranged from .92-.96 across four validation samples), and validity (content, face, factor-analytical, convergent, discriminant, criterion-group) (Barriga, Gibbs, Potter, & Liau, 2001).

_**Empathy.**_ Cognitive and affective empathy were measured using the Interpersonal Reactivity Index (IRI) (Davis, 1983) is a paper-and-pencil measure of empathy. It is comprised of 28 items scored on a four-point Likert-type scale, with seven items on each of four subscales: empathic concern (EC), perspective taking (PT), personal distress (PD), and fantasy (FS) (see Appendix B). Two of the subscales, EC and PT, have been found to be most consistently related to empathic concern for a distressed target individual. Thus, in line with previous work by Barriga and colleagues (2009), the proposed study will use the seven PT items to represent cognitive aspects of empathy and the seven EC items to represent affective aspects of empathy. Perspective-Taking items refer to one’s tendency to consider others’ viewpoints; e.g., “I try to look at everybody’s side of a disagreement before I make a decision.” Empathic Concern items assess one’s
tendency to emotionally respond to another person’s emotional state; e.g., “I often have
tender, concerned feelings for people less fortunate than me.” The IRI evidences good
internal reliability (alpha = .72-.78), test-retest reliability (r= .61-.81), and validity
(Davis, 1983).

Antisocial and Internalizing Behavior. Both antisocial and internalizing behaviors
were measured using the Adult Self Report (ASR), developed by Achenbach and
Rescorla (2003). The ASR is a self-administered paper-and-pencil instrument for adults
(ages 18-59) to report their own adaptive functioning, problems, and substance use (see
Appendix C). It contains 123 items that are scored on a 3-point Likert-type scale (0= not
true, 1 = somewhat or sometimes true, 2 = very true or often true). The problem scale
consists of items pertaining to one of eight syndromes (anxious/depressed, withdrawn,
somatic complaints, thought problems, attention problems, aggressive behavior, rule
breaking behavior, and intrusive symptoms). Six of the syndromes can be classified as
either externalizing/antisocial (aggressive behavior, rule-breaking behavior, and intrusive
symptoms) or internalizing (anxious/depressed, withdrawn, somatic complaints). The
proposed study is primarily interested in the response data from these two subscales and
their respective components. The ASR evidences good test-retest reliability (r=.88),
internal consistency (alpha = .83), and validity (content, construct, and criterion-related)
(Achenbach & Rescorla, 2003).

Aggression. Reactive and proactive aggression was measured using Raine and
colleagues’ (Raine et al., 2006) Reactive-Proactive Questionnaire (RPQ). The RPQ is a
paper-and pencil measure of proactive and reactive subtypes of aggressive behavior (see
Appendix D). Literature suggests that proactive and reactive subtypes of aggression have somewhat different etiologies. The RPQ provides a measure to distinguish these two types of aggression. It is comprised of 23 items scored on a three-point Likert scale (0 = never, 1 = sometimes, 2 = often). Of the 23 items, 12 pertain to proactive-aggressive behavior and 11 pertain to reactive-aggressive behavior. Proactive items refer to aggression that is instrumental and organized; e.g., “How often have you had fights with others to show who was on top?” Reactive items refer to aggression that is fear-induced, irritable, and defensive response to provocation; e.g. “How often have you yelled at others when they have annoyed you?” In addition to providing scale scores for the aggression subtypes, the scales can be aggregated to provide an overall aggression score. The RPQ scales evidence good internal reliability (all alphas > 0.83), and validity (construct, criterion, & discriminant) (for specific values see Raine et al., 2006).

Neurological Proxy Measures:

Ventromedial Prefrontal Cortical Function. The PEBL Gambling Task (Mueuller, 2010) was used as a proxy measure for vmPFC function. Participants completed a computerized task that is based on the Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994). Originally, the IGT was developed to capture and evaluate deficits in emotional processing, decision-making, and social skills of individuals with orbitofrontal/ventromedial prefrontal cortex lesions. Since its inception, the IGT has been shown to be a highly sensitive measure in a variety of contexts, including individuals with psychopathological conditions (Best et al., 2002; van Honk et al., 2002), offenders/delinquent populations (Kim, Lee, & Kim, 2006; Miura, 2009), and non-
clinical populations (Sweitzer, Allen, & Kaut, 2008; Hooper, Luciana, Conklin, & Yarger, 2004; Hooper et al., 2008). The extant literature suggests that, after controlling for executive function deficits (dIPFC), the IGT can be used to identify emotional processing, social skills, and decision-making deficits associated with mOFC/vmPFC function (Bechara, 2007); neuroimaging studies have provided further support for this conclusion (Li et al., 2010). The IGT has evidenced excellent validity and good consistency across various populations (Bechara, 2007).

The task requires participants to continuously make selections (100 trials) from among four decks of cards that vary in their amounts of monetary reward and their amount/frequency of punishment (monetary loss). The participant’s goal is to earn as much (imaginary) money as possible (see Appendix E for specific instructions). Of the four decks of cards, there are two “advantaged” and two “disadvantaged” decks. In the disadvantaged decks (C and D), immediate gains are large, but continued selection yields a net loss (due to frequent or large punishments). In the advantaged decks (A and B), immediate gains are small, but continued selection yields a net gain (due to infrequent or small punishments) (see Figure 1).

Successful performance relies on the individual’s ability to avoid short-term gains in return for a beneficial long-term outcome. Typically, “normal” populations learn to select from advantageous decks (over trials/blocks); whereas, individuals with decision-making deficits continue to select from disadvantaged decks.

The present study we used an implementation of the IGT created using the Psychology Experiment Building Language (PEBL) (Mueller, 2010). The PEBL version
of the IGT (PBGT) is psychometrically identical to the original version created by Bechara et al. (1994). The number of cards in each deck, the magnitude and frequency of reward/punishment schedules, and participant instructions, all remain the same. Thus, the reliability and validity statements attributed to the IGT, as well as the generated norm data, are fully transferable to the PEBL implementation. Using this implementation offered a unique benefit to the study. Unlike the original IGT, the PEBL implementation allows for group administration. This greatly increased the rate at which data could be collected from participants.
Dorsolateral Prefrontal Cortical Function. Participants completed the Aospan (Unsworth, Heitz, Schrock, & Engle, 2005), a well-known dlPFC proxy measure. The Aospan, adapted from Turner and Engle (1989), is a computerized task used to measure working memory. Tasks of working memory, such as the operational span, are heavily reliant of dlPFC function (Osaka et al., 2007). The computer task requires participants to solve a series of math operations while trying to remember a set of unrelated letters (see Appendix F for written instructions). In each trial, participants are briefly presented a mathematical operation and then asked to verify (using a computer mouse) whether a given response is correct or incorrect. Immediately following the math verification, the participant is presented with a letter that he/she needs to remember at the end of the block. The blocks vary in length, ranging from 3 to 7 operations/letters. At the end of each block, participants are asked to select, in order, which letters they recall. The Operation Span score is determined by the number of letters recalled in their correct order. In order for scores to be valid, the participant must have correctly verified 80% of the math operations. This is to ensure that participants completed the task as intended. When conditions are met, performance on the Aospan can be used to assess individual differences, as well as deficits, in dlPFC function. The Aospan has both good internal consistency (alpha = .78) and test-retest reliability (.83), and correlates well with other measures of working memory capacity (Unsworth et al., 2005).
Procedure

Participants were recruited for the study using the OSU Psychology REP Online website. An experiment advertisement was posted to the website which included information on the purpose of the study, details of participation, and eligibility requirements (see Appendix G). Participants were offered course credit for participation. Individuals who met the eligibility requirements and wished to participate signed up for the study via the website.

An experimenter met participants in a designated waiting area and led them to a computer lab where the study took place. Participants were each assigned a computer to use for the neurological proxy tasks. The experimenter distributed consent forms (see Appendix H) and packets containing the questionnaire measures. Participants were given a verbal explanation of the study and then asked to read the consent form carefully. After obtaining consent, the experimenter gave general instructions and explained the format of the study. During the 1.5 hour session, participants were asked to complete the paper-and-pencil self-report questionnaires (IGT, ASR, IRI, & RPQ) as well as the two computer tasks (PBG, & Aospan). The presentation order of the tasks/questionnaires was partially counterbalanced. A Latin Square procedure was used to counterbalance the questionnaire measures. The presentation of the computer tasks was also counterbalanced and either preceded or followed the questionnaire measures. All measures were group administered (group size ~ 10). To minimize distractions, the group of participants began each measure at the same time.
At the conclusion of the session, participants were fully debriefed. In addition to a
verbal explanation, participants were provided with a printed debriefing document (see
Appendix I). As part of receiving course credit, they were also given a student report
form to complete and submit to the REP coordinator. The experimenter offered to answer
any questions about the nature of the study or use of the data. Participants were instructed
to contact the principal investigator with any future inquiries about the study.
Chapter 3: Results

This chapter reports results from data analyses conducted to address the thesis’ primary and secondary exploratory aims. Prior to the main analyses, a preliminary analysis provides descriptive statistics as well as intercorrelations among subscales of the major variables of interest. The main analyses pertain to the interrelationships of SSCDs, vmPFC function, and antisocial behavior. The secondary analyses explore relationships of SSCDs and vmPFC function with both empathy and aggression. (Note: Inclusion of analyses pertaining to the role of DLPFC function was preempted by lack of pertinent systematic results concerning correlational relationships with the vmPFC proxy measure; see below.)

Preliminary Analyses

Descriptive Statistics of Measures

To evaluate the distribution of scores on the study measures, descriptive statistics were calculated. Table 1 presents data for the minimum, maximum, mean, and standard deviation of scores on the major variables of interest. The mean score and standard deviation for SSCD total as measured by the HIT questionnaire is similar to other normative sample studies (see Barriga et al., 2001). The Antisocial Behavior and Internalizing Behavior components of the ASR evidence a wide range of scores with
means below established clinical cut-off points (see Achenbach & Rescorla, 2003); This is expected in non-clinical populations. The range of IGT net scores included both negative and positive values, indicating that the sample included both disadvantageous and advantageous decision-makers. Mean score and standard deviation on the Aospan in the present sample are highly similar to the values of the original validation study (M = 39.16, SD = 17.41; Unsworth et al., 2005). Similarly, mean scores on the empathy components were consistent with values presented in the IRI validation study (see Engle, 1980). On the reactive subscale of the RPQ, mean score and standard deviation were consistent with the original validation sample; however, values for the proactive subscale were slightly lower than the validation sample (see Raine et al., 2006). The lower mean and standard deviation on the proactive subscale of the RPQ is likely due to the infrequency of proactive aggression in normative samples coupled with the relatively small sample size.
Table 1

Descriptive Statistics for Major Study Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCD Total</td>
<td>116</td>
<td>1.11</td>
<td>4.21</td>
<td>2.13</td>
<td>.53</td>
</tr>
<tr>
<td>Antisocial Behavior</td>
<td>116</td>
<td>0.00</td>
<td>56.00</td>
<td>14.03</td>
<td>8.63</td>
</tr>
<tr>
<td>Internalizing Behavior</td>
<td>116</td>
<td>0.00</td>
<td>71.00</td>
<td>17.59</td>
<td>12.26</td>
</tr>
<tr>
<td>IGT Score (vmPFC)</td>
<td>116</td>
<td>-58.00</td>
<td>76.00</td>
<td>9.21</td>
<td>23.31</td>
</tr>
<tr>
<td>Aospan Score (dIPFC)</td>
<td>116</td>
<td>0.00</td>
<td>75.00</td>
<td>44.05</td>
<td>18.99</td>
</tr>
<tr>
<td>Empathy Total</td>
<td>116</td>
<td>16.00</td>
<td>58.00</td>
<td>38.22</td>
<td>7.39</td>
</tr>
<tr>
<td>Cognitive</td>
<td>116</td>
<td>3.00</td>
<td>28.00</td>
<td>18.02</td>
<td>4.72</td>
</tr>
<tr>
<td>Affective</td>
<td>116</td>
<td>5.00</td>
<td>28.00</td>
<td>20.09</td>
<td>4.23</td>
</tr>
<tr>
<td>Aggression Total</td>
<td>43</td>
<td>0.00</td>
<td>24.00</td>
<td>9.19</td>
<td>5.69</td>
</tr>
<tr>
<td>Reactive</td>
<td>43</td>
<td>0.00</td>
<td>20.00</td>
<td>7.40</td>
<td>4.39</td>
</tr>
<tr>
<td>Proactive</td>
<td>43</td>
<td>0.00</td>
<td>5.00</td>
<td>1.79</td>
<td>1.81</td>
</tr>
</tbody>
</table>

Intercorrelations of Measure Subscales

In order to evaluate the relationships between subscale scores and total scale scores for study measures, correlation matrices were constructed. Specifically, intercorrelations between subscale scores and total scale scores were calculated for the SSCDs (HIT), antisocial behavior (ASR), and empathy (IRI).
A zero-order correlation matrix was constructed to examine the relationships among the subscale and total scale scores for the HIT measure of SSCDs. The data presented in Table 2 indicate that high positive correlations exist between the subscales and total scale score, as well as among the subscales. Correlations between the subscales and total scale score range from .88 (Self-Centered & SSCD Total) to .94 (Overt & SSCD Total; Covert & SSCD Total). Correlations among the subscales ranged from .69 (Blame Others & Self-Centered) to .93 (Assume Worst & Overt). These correlations support that the subscales combine to measure a single, overarching construct (i.e., SSCD), but that each subscale represents a unique component of that construct.

Table 2

Zero-Order Correlation Matrix of Total and Subscale scores on the HIT Measure of SSCD (N = 116)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SSCD Total</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SSCD Overt</td>
<td>.94**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SSCD Covert</td>
<td>.94**</td>
<td>.78**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. SSCD Self-Centered</td>
<td>.88**</td>
<td>.82**</td>
<td>.83**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. SSCD Assume Worst</td>
<td>.92**</td>
<td>.93**</td>
<td>.82**</td>
<td>.73**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. SSCD Min/Mislabel</td>
<td>.93**</td>
<td>.87**</td>
<td>.88**</td>
<td>.81**</td>
<td>.81**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. SSCD Blame Others</td>
<td>.90**</td>
<td>.82**</td>
<td>.88**</td>
<td>.69**</td>
<td>.80**</td>
<td>.76**</td>
<td>1</td>
</tr>
</tbody>
</table>

**p < .01.
Table 3 presents zero-order correlations among the subscales and total scale scores for the ASR measure of antisocial behavior. The data indicate that the aggressive, rule breaking, and intrusive subtypes evidence moderate to high positive correlations with overall antisocial behavior. Of the subscales, the intrusive subtype shows the smallest correlation with total antisocial behavior.

Table 3

Zero-Order Correlation Matrix of Overall and Subtype Scores of the ASR Measure of Antisocial Behavior (N = 116)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Antisocial Behavior</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Aggressive Subtype</td>
<td>.85**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Rule Breaking Subtype</td>
<td>.84**</td>
<td>.51**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. Intrusive Subtype</td>
<td>.61**</td>
<td>.29**</td>
<td>.40**</td>
<td>1</td>
</tr>
</tbody>
</table>

**p < .01

Zero-order correlation coefficients were also calculated for cognitive, affective, and total empathy as measured by the IRI. Results indicate that the overall empathy score evidences high positive correlations scores on both the affective (r = .79, p < .001) and cognitive (r = .82, p < .001) subscales. The affective and cognitive subscales were moderately correlated with one another (r = .32, p < .001); indicating that they are similar yet distinct components of empathy.
Main Analyses

SSCDs and Antisocial Behavior

Table 4 presents the zero-order correlations between SSCDs and antisocial behavior. The table includes correlations among and between the overall scale scores and subscale scores for each measure. Results indicate that overall level of SSCD as assessed by the HIT questionnaire is significantly correlated with self-reported antisocial behavior. Specifically, the data support that as self-reported antisocial behavior increases, individuals endorse higher levels of SSCDs. In the present sample, SSCDs account for 13% of the variance associated with antisocial behavior. The data also show that the individual SSCD subscales evidence moderate positive correlations with overall antisocial behavior. Correlations are also provided for SSCD scale scores with antisocial behavior subtypes (i.e., Aggressive, Rule Breaking, & Intrusive). Overall SSCD score shows moderate positive correlations with aggressive and rule breaking subtypes of antisocial behavior, but not with the intrusive subtype. Most of the SSCD subscales evidence a similar pattern in regards to correlations with subtypes of antisocial behavior. One exception is the SSCD Covert subscale, which is only significantly correlated with the rule breaking subtype of self-reported antisocial behavior.
Table 4

Zero-order Correlations of SSCDs with Antisocial Behavior and Antisocial Behavior Subtypes (N = 114)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Antisocial Behavior</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aggressive</td>
<td>Rule Breaking</td>
<td>Intrusive</td>
</tr>
<tr>
<td>SSCD Total</td>
<td>.36**</td>
<td>.32**</td>
<td>.31**</td>
<td>.11</td>
</tr>
<tr>
<td>SSCD Overt</td>
<td>.43**</td>
<td>.44**</td>
<td>.32**</td>
<td>.12</td>
</tr>
<tr>
<td>SSCD Covert</td>
<td>.25*</td>
<td>.18</td>
<td>.27**</td>
<td>.10</td>
</tr>
<tr>
<td>SSCD Self-Centered</td>
<td>.36**</td>
<td>.24*</td>
<td>.42**</td>
<td>.12</td>
</tr>
<tr>
<td>SSCD Assume Worst</td>
<td>.40**</td>
<td>.43**</td>
<td>.26**</td>
<td>.12</td>
</tr>
<tr>
<td>SSCD Min/Mislabel</td>
<td>.29**</td>
<td>.23*</td>
<td>.27**</td>
<td>.11</td>
</tr>
<tr>
<td>SSCD Blame Others</td>
<td>.26**</td>
<td>.28**</td>
<td>.19*</td>
<td>.06</td>
</tr>
</tbody>
</table>

*Note.* Participants 64 and 65 were identified as outliers in a simple regression of SSCD on antisocial behavior and were subsequently removed from the correlation analysis.

*p < .05, **p < .01.

Given the high positive correlation between SSCDs and antisocial behavior, a hierarchical regression analysis was conducted to establish whether SSCDs significantly predicted self-reported antisocial behavior after controlling for potential covariates (see Table 5). Age and gender were accounted for in steps 1 and 2 of the regression equation, respectively. Neither variable provided statistically significant predictive ability in self-reported antisocial behavior. Internalizing behavior was entered in step 3 of the
regression equation. A preliminary analysis of the data indicated that internalizing behavior was significantly correlated with antisocial behavior ($r = .61$, $p < .001$). Thus, in line with previous studies, internalizing behavior was included as a potential covariate. The addition of internalizing behavior significantly improved the model, accounting for 28.3% of unique variance associated with self-reported antisocial behavior. Overall HIT score (i.e., total SSCD) was entered in step 4. The addition of HIT (SSCD) score significantly improved the variance predicted by the model. In the final model, SSCDs and Internalizing behavior were significant predictors of antisocial behavior. HIT score accounted for 5.57% unique variance; whereas, internalizing behavior accounted for 18.8% unique variance in self-reported antisocial behavior. Overall, the model accounts for 37% of the variance in self-reported antisocial behavior, indicating a large effect.
Table 5

*Summary of Hierarchical Regression Analysis for SSCDs (HIT Score) Predicting Self-Reported Antisocial Behavior (N = 114)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
<th>Model 3</th>
<th></th>
<th></th>
<th>Model 4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
<td>β</td>
<td>B</td>
<td>SE B</td>
<td>β</td>
<td>B</td>
<td>SE B</td>
<td>β</td>
<td>B</td>
<td>SE(B)</td>
</tr>
<tr>
<td>Age</td>
<td>-3.06</td>
<td>0.19</td>
<td>0.15</td>
<td>-0.32</td>
<td>0.19</td>
<td>-0.15</td>
<td>-0.29</td>
<td>0.16</td>
<td>-0.14</td>
<td>-0.25</td>
<td>1.57</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.66</td>
<td>1.39</td>
<td>0.11</td>
<td>-0.24</td>
<td>1.21</td>
</tr>
<tr>
<td>Internalizing</td>
<td></td>
<td></td>
<td></td>
<td>0.36</td>
<td>0.05</td>
<td>0.55**</td>
<td></td>
<td>0.31</td>
<td>0.05</td>
<td>0.47**</td>
<td></td>
</tr>
<tr>
<td>HIT Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.60</td>
<td>1.16</td>
<td>0.26**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .02 \quad .03 \quad .32 \quad .37 \]

\[ F \text{ for change in } R^2 = 2.52 \quad 1.42 \quad 45.53** \quad 9.69** \]

Note. Participants 64 and 65 were identified as outliers and subsequently removed from the regression

**p < .01**
vmPFC function and Antisocial Behavior

In order to explore the relationship between vmPFC function and antisocial behavior, a Pearson product-moment correlation was computed for overall IGT score and ASR antisocial behavior score. The correlation between the variables was nonsignificant (r = -.04, n = 116, p > .05). Figure 2 provides a scatter plot as a visual representation of the relationship between antisocial behavior score and overall IGT score. The scatterplot was constructed to establish: (1) if the correlational relationship was influenced by excessive noise at mean levels of the construct, or (2) whether a nonlinear relationship exists between vmPFC function and antisocial behavior. Examination of the scatter plot does not suggest that the relationship was influenced by excessive noise, nor does it indicate a non-linear relationship.
Figure 2. Scatterplot of overall IGT score and ASR antisocial behavior score (N = 116).

SSCD and vmPFC function

Despite a nonsignificant relationship with antisocial behavior, zero-order order correlations were still calculated to explore the relationship of vmPFC function with SSCDs. Table 6 presents correlations between SSCD scale scores (total and subscale scores) and overall IGT score. Neither overall SSCD score nor any of the individual SSCD subscale scores were significantly correlated with overall IGT score. Due to the
nonsignificant correlations between the variables, no further analyses (e.g., linear regression) were conducted to examine their relationship.

Table 6

Zero-Order Correlations between SSCD Scores and Overall IGT Score (N = 116)

<table>
<thead>
<tr>
<th>Variables</th>
<th>IGT Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCD Total</td>
<td>-.03</td>
</tr>
<tr>
<td>SSCD Overt</td>
<td>.01</td>
</tr>
<tr>
<td>SSCD Covert</td>
<td>-.06</td>
</tr>
<tr>
<td>SSCD Self-Centered</td>
<td>-.12</td>
</tr>
<tr>
<td>SSCD Assuming Worst</td>
<td>-.04</td>
</tr>
<tr>
<td>SSCD Min/Mislabel</td>
<td>-.02</td>
</tr>
<tr>
<td>SSCD Blaming Others</td>
<td>.09</td>
</tr>
</tbody>
</table>

*Note. All p-values > .1*

**Secondary Analyses**

**SSCDs and vmPFC function with Empathy**

Empathy has been implicated in the relationship of SSCDs and vmPFC function to antisocial behavior. In the present sample, empathy was inversely correlated with antisocial behavior ($r = -.254, N = 116, p < .001$). Table 7 presents zero-order correlations that were calculated to assess the potential relationships of SSCDs and/or vmPFC function to empathy. The correlations examined the relationships of overall
SSCD score and IGT total score with total empathy, as well as affective and cognitive empathy components. Overall SSCD score evidenced significant inverse correlations with total empathy, affective empathy, and cognitive empathy. The data indicate that SSCDs are most strongly correlated with the affective component of empathy. Despite trending in the anticipated direction, none of the correlations between IGT total score and empathy scores reached significance (all p-values > .1).

Table 7

*Zero-Order Correlations of SSCD and IGT Scores with Empathy (N = 116)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>SSCD Total</th>
<th>IGT Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empathy Total</td>
<td>-.42**</td>
<td>.15</td>
</tr>
<tr>
<td>Affective Empathy</td>
<td>-.45**</td>
<td>.11</td>
</tr>
<tr>
<td>Cognitive Empathy</td>
<td>-.26**</td>
<td>.15</td>
</tr>
</tbody>
</table>

** p < .01

To illustrate the inverse linear relationship between SSCD total score and empathy total score, a scatter plot was constructed (see Figure 3). The plot reveals that as scores on the empathy measure increase, endorsement of SSCD items decreases. A linear regression line was also fitted to the plot, indicating that SSCDs account for 17.7% of variance in self-reported overall empathy.
Figure 3. Scatterplot of IRI total empathy score and HIT SSCD total score.

SSCDs and vmPFC function with Aggression

Zero-order correlations were calculated to investigate whether SSCDs and/or vmPFC function showed differential relationships to subtypes of aggression (see Table 8). SSCD total score was not significantly correlated with overall aggression, or with either of the subtypes. Overt referential distortions evidenced a moderate positive correlation with proactive, but not reactive, aggression. Covert referential distortions were not significantly correlated to either subtype of aggressive behavior. Similarly, all
correlations between IGT total score and aggression were nonsignificant. It is worth noting, however, that low power caused by the small sample size for the RPQ (N=44) may have resulted in several trending correlations not reaching significance.

Table 8

Zero-Order correlations of SSCD and IGT Scores with Aggression and Aggression Subtypes (N = 44)

<table>
<thead>
<tr>
<th>Variables</th>
<th>RPQ Proactive</th>
<th>RPQ Reactive</th>
<th>RPQ Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCD Total</td>
<td>.21</td>
<td>-.02</td>
<td>.05</td>
</tr>
<tr>
<td>SSCD Overt</td>
<td>.37*</td>
<td>.22</td>
<td>.28</td>
</tr>
<tr>
<td>SSCD Covert</td>
<td>.04</td>
<td>-.24</td>
<td>-.17</td>
</tr>
<tr>
<td>Overall IGT (vmPFC)</td>
<td>.02</td>
<td>.05</td>
<td>.04</td>
</tr>
</tbody>
</table>

*p < .05
Chapter 4: Discussion

The present study was conducted as an exploratory analysis of potential relationships between SSCDs, vmPFC function, and their respective roles in relation to antisocial behavior. Previous studies have examined individual relationships of SSCDs and vmPFC function to antisocial behavior. Findings from this literature suggest several similarities in the way that SSCDs and vmPFC function relate to antisocial behavior. Furthermore, recent findings on CU traits are consistent with an inverse relation between vmPFC function and SSCDs. Despite the relational similarities and preliminary CU trait evidence, previous studies have failed to explore relationships across SSCDs, vmPFC functioning, and antisocial behavior.

To begin addressing this gap in the literature, the present study had primary and secondary aims. The primary aims pertained to the relationships of SSCDs and vmPFC function to antisocial behavior. We sought to determine whether relationships found in previous studies held in the current sample. We also examined whether the endorsement of SSCDs was related to vmPFC function. The exploration of a potential relationship between these two processes served as the fundamental objective of the present research. In terms of secondary aims, we examined the individual relationships of SSCDs and vmPFC function with both empathy and aggression subtypes. This chapter discusses the study’s results, limitations, directions for future research, and implications.
Main Findings

Consistent with the extant literature, we found that SSCDs correlated with self-reported antisocial behavior. Individuals who endorsed high levels of SSCDs self-reported higher than average levels of antisocial behavior. In addition to their relationship with overall antisocial behavior, SSCDs were also positively correlated with aggression and rule-breaking subtypes. Somewhat surprisingly, however, SSCDs were not correlated with the intrusive behavior subtype. Intrusive behavior is the least severe subtype of antisocial behavior and was frequently reported in the present sample. Given that intrusive behaviors are frequently endorsed, they may be considered more acceptable than other types of antisocial behaviors. Therefore, SSCDs may not be necessary to engage in, or reduce guilt from, intrusive behaviors.

Since antisocial behavior evidences high comorbidity with internalizing symptomology, we were specifically interested in investigating whether SSCDs could account for antisocial behavior even after controlling for variance attributable to internalizing problems. In line with previous research (Barriga et al., 2000), we found that SSCDs predict self-reported antisocial behavior even after controlling for demographic variables and internalizing problems. Together, the zero-order correlations and hierarchical regression are consistent with claims that self-exculpatory cognitive processes are an important factor when accounting for antisocial behavior (Sykes & Matza, 1957; Yochelson & Samenow, 1976, Bandura et al., 1996; Gibbs, 2010).
Furthermore, the results suggest that this relationship holds even in non-clinical populations such as the mainstream sample used in the present study.

In contrast to previous studies (Hooper et al., 2008; Strenziok et al., 2011), performance on the vmPFC proxy task did not show an inverse correlation with self-reported antisocial behavior. This indicates that, at least in the current sample, individual differences in vmPFC function do not account for antisocial behavioral tendencies. This result lends itself to several possible explanations. The most forthright explanation is that low vmPFC functioning in non-clinical populations is not related to increased antisocial behavior. While many studies indicate that attenuated vmPFC function is responsible for antisocial tendencies in clinical (e.g. psychopaths) and focal lesion patients, there are significantly fewer studies suggesting that decreased vmPFC functioning is responsible for similar behavior patterns in non-clinical populations. It may be that, once a threshold of functioning is reached during development, the vmPFC is capable of inhibiting antisocial tendencies. This would explain why vmPFC deficits in brain lesion patients and psychopaths result in an increased propensity for antisocial behavior, but individual differences evident in the present sample do not.

An alternative explanation is that the proxy measure used to operationalize vmPFC function was inadequate. Studies have argued that gambling tasks similar to that of the IGT are not good proxy measures of vmPFC function. Some of these studies suggest that the task is too complex and recruits multiple prefrontal regions (Ernst et al., 2002), while others argue that confounds exist in the measure design (Chiu & Lin, 2007; Lin, Chiu, Lee, & Hsieh, 2007). If so, a relationship with antisocial behavior may exist but
was not identified due to the poor operationalization of vmPFC function. That said, the vmPFC proxy measure chosen for the present study is identical to the one used in the studies evidencing a relationship with antisocial behavior. Furthermore, the neuroimaging study by Li et al. (2010) confirms that vmPFC function is essential for successful IGT performance.

It is impossible to determine which, if either, of these explanations is correct. Thus, it is imperative that future studies attempt to replicate previous findings that suggest a relationship between vmPFC function and antisocial behavior in normative samples.

An additional primary aim was to explore the potential relationship between SSCDs and vmPFC function. Indeed, previous studies indicating a relationship between CU traits and SSCDs (Charbrol et al. 2011, Shulman et al., 2011) suggested the possibility of an inverse correlation between vmPFC function and SSCDs. If this relationship existed, it would provide a novel finding suggesting that the vmPFC is a functional neural correlate of SSCDs. However, we found no such relationship. Given that the vmPFC proxy measure did not correlate with antisocial behavior, this result was not particularly surprising. The relationship between SSCDs and vmPFC function partially hinged on both being individually related to antisocial behavior.

The lack of relationship between SSCDs and vmPFC function lends itself to at least two possible explanations. First, and most straightforward, is that vmPFC function is not related to endorsement of SSCDs. It may be that self-exculpatory cognitive processes are not influenced by neural function in the vmPFC region. In other words, it is
possible that the vmPFC is not a functional neural correlate of SSCDs. Although the vmPFC proved the most likely candidate for a neurological anchor of SSCDs, it may be that other prefrontal regions are responsible for self-exculpatory cognitive frameworks.

A second possible explanation concerns the proxy measure of vmPFC function. As stated earlier, it may be that the gambling task is an inadequate operationalization of vmPFC function. Thus, a relationship could exist but we failed to identify it due to our choice of neurological proxy task.

Again, it is impossible to determine which of these explanations is correct. Furthermore, there are likely additional possibilities; however, these explanations seemed most plausible.

Secondary Findings

In addition to its primary aims, the present study also entailed two secondary aims, the first of which pertained to empathy. In the extant literature, both SSCDs and vmPFC function have exhibited relationships with empathy. Accordingly, we sought to replicate and extend these findings by exploring potential relationships of SSCDs and vmPFC function to both cognitive and affective components of empathy. Consistent with previous studies (Barriga et al., 2009, McCrady et al., 2008), we found that SSCDs were inversely correlated with empathy. That is, individuals demonstrating high levels of SSCDs exhibited lower empathy compared to individuals evidencing low SSCDs. This finding lends additional correlational support to Gibbs and colleagues’ (Gibbs & Potter,
1993; Gibbs, 2010) theoretical suggestion that SSCDs function to reduce empathic guilt associated with offending.

A somewhat novel finding of the present study is that SSCDs were more strongly correlated with the affective component of empathy ($r = -.45$) compared to the cognitive component ($r = -.26$). It is important to note that both of the correlations were significant. That said, this result suggests that extensive use of SSCDs is most closely related to affective aspects of empathy. Following Gibbs and colleagues’ interpretation of the relationship between SSCDs and empathy, the use of SSCDs may possibly play a larger role in neutralizing negative feelings associated with offending compared to its role in diminishing perspective-taking.

Several accounts of vmPFC function have implicated its role in empathy (see Mendez, 2009). In the current study, however, the correlation between vmPFC function and empathy was nonsignificant. The correlations with the cognitive and affective components of empathy were also nonsignificant. It is worth mentioning, that although the correlations failed to reach significance, they were trending in the appropriate direction. That is, individuals who scored low on the vmPFC proxy measure reported lower empathy. With an increase in statistical power, it is possible that the relationship between vmPFC function and empathy would reach significance.

In addition to the secondary aim of exploring the relationships of SSCDs and vmPFC function to overall antisocial behavior, we also examined how each related to reactive and proactive subtypes of aggression. The purpose of this secondary aim was twofold. First, the inclusion of the aggression questionnaire provided an additional, albeit
more specific, measure of antisocial behavior. Second, as mentioned in Chapter 1, reactive and proactive aggression evidence different etiologies and may be associated with different cognitive and neurological processes. Therefore, we were interested in investigating whether SSCDs and/or vmPFC function differentially related to subtypes of aggression. It is important to note that the reactive/proactive aggression measure was implemented midway through data collection, resulting in a small sample size (N = 43). As such, the statistical power is quite low and results must be interpreted cautiously. In the present study, vmPFC function was not correlated with either subtype of aggression. Given that vmPFC function did not exhibit correlations with the aggression subscale on the ASR, this result was not particularly surprising. On the other hand, overt referential SSCDs were significantly correlated with proactive aggressive behavior. The correlation of overt SSCDs was trending in the appropriate direction; however, it was nonsignificant. With an increase in power, it is likely that this result would reach significance. Covert referential SSCDs did not evidence correlations with reactive or proactive aggression. This is consistent with the cognitive-behavioral specificity findings of Barriga et al. (2008), who found that overt distortions were linked to aggressive behaviors, whereas covert distortions were related to delinquent behaviors. These results suggest that an individual’s self-exculpatory cognitive frameworks are specific to the type of antisocial behavior in which he/she is engaged.
**Limitations**

This study was subject to several noteworthy limitations. One limitation pertains to the sample used in the current study. Participants were introductory psychology students who were part of the Research Experience Program (REP) at The Ohio State University. This population was chosen, in part, because the study called for a normative (non-clinical) sample. However, it is likely that university students evidence lower levels of antisocial behavior compared to the general population. Thus, it would have been more appropriate to employ true probability sampling and draw the study sample from the general population. Given the use of a relatively small convenience sample, one must be cautious in generalizing the present findings.

A second limitation concerns the study’s correlational design. Because the study was correlational, no conclusions about the directionality of causation can be drawn from the current results. Therefore, we are unable to conclude whether SSCDs cause, or are a product of, antisocial behavior.

Since several measures used in the present study were self-report, they were susceptible to response bias and social desirability. We tried to minimize these effects using two methods. Prior to completing the self-report measures, participants were reminded that their responses were anonymous and that the results of the study depended on their accurate and honest answers. Additionally, the anomalous responding scale on the HIT measure of SSCDs was used to identify participants responding in a socially desirable manner. Individuals identified as anomalous responders were not included in
the final analysis. Despite these efforts, biased responses may still have influenced the results.

Additional limitations pertain to the proxy measures used to represent cortical function. Proxy measures are just that: a stand in or substitute. Two proxy measures used in this study are behavioral tasks that are thought to be representative of functioning in specific cortical regions (i.e., vmPFC, dIPFC). Although performances on these tasks have shown consistent correlations with specific brain regions, they are by no means a precise or direct measure of cortical functioning. In fact, many neurological proxy measures, including the IGT, have been shown to recruit multiple cortical regions. In the present study, we did our best to isolate vmPFC function associated with the IGT by statistically controlling for variance attributable to working memory (dIPFC). Still, one must be cautious when drawing conclusions about cortical functioning from behavioral proxy measures. A related limitation concerns the use of a single proxy measure to account for vmPFC function. Given the limitations of neurological proxy tasks, it would have been beneficial to include multiple measures of vmPFC function. By doing so, we would have been more confident that variance was due to difference in vmPFC function and not measurement error.

Future Directions

The study results and aforementioned limitations offer several directions for future research. For instance, future studies should use functional neuroimaging techniques when attempting to identify neural correlates of SSCDs. The benefits of using
neuroimaging technology in this context are twofold. First, employing this methodology would alleviate the limitations of using proxy measures. Functional imaging technology, while not perfect, would provide a far more precise measure of cortical activity compared to the proxy tasks used in the present study. As such, drawing conclusions from study results would be more straightforward. Second, neuroimaging techniques such as fMRI would allow researchers to evaluate the entire cortex for possible neural correlates of SSCDs. Compared to the methodology employed in the present study, these techniques would provide a much more efficient means of identifying cortical areas associated with SSCDs.

Neuroimaging techniques, although a step in the right direction, do not solve all of the limitations facing the present line of research. As noted in Chapter 1, an enduring limitation of the literature on SSCDs concerns the temporal relationship with antisocial behavior. It is unclear when SSCDs occur in the chronology of offending. Resolving this limitation would have significant implications in understanding the true function of SSCDs in their relationship with antisocial behavior. It would give insight into how and when SSCDs interact with other processes in regards to antisocial behavior. Therefore, in future studies, researchers should give considerable effort to designing an experimental or longitudinal design to determine the causal direction of this relationship. Given the nature of SSCDs, it may be difficult to imagine an appropriate experimental design for this purpose. However, this design would provide the optimal way to establish the causal direction of the relationship between SSCDs and antisocial behavior.
The present study also implies several future directions for research regarding vmPFC function. First and foremost, additional studies should be conducted to determine if individual differences in vmPFC function account for antisocial behavior in normative samples. There are relatively few studies that provide evidence supporting an inverse correlation between vmPFC function and self/parent – reported antisocial behavior. Furthermore, although the present study is not conclusive, it calls into question the findings of these previous studies. Future research should aim to replicate the previous findings to determine if, in fact, a relationship exists. If it does, research should proceed further to identify what specific subtypes of antisocial behavior are related vmPFC deficits. Given the complex nature of antisocial behavior, it is likely that vmPFC function is related to some but not other aspects of antisocial behavior.

Other research should aim to identify the specific functions of the vmPFC. Although correlational relationships have been established with vmPFC functioning, there is still some disagreement about its specific purpose(s) (e.g., emotion regulation, emotion/cognition integration, fear response, reversal learning). This is to be expected, as neuroimaging techniques and their accompanying theories are relatively new. However, as the field of social cognitive neuroscience matures, it will be necessary to reach a consensus as to what cognitive processes recruit the vmPFC. It is possible, and likely, that the vmPFC serves multiple functions. These functions may be distributed throughout the vmPFC, or localized to a specific subregion (e.g., r-vmPFC, l-vmPFC). All of these are possibilities and remain an empirical question. While initial steps have been taken, we are still far from completely understanding the vmPFC.
Conclusions

The present study attempted to advance our current understanding of antisocial behavior by interrelating processes across two levels of analysis. Although many of the results of this study were nonsignificant, the study is relevant for several reasons. In regard to SSCDs, correlations with antisocial behavior in the present study corroborate results from the extant literature. The body of work on SSCDs, including our present findings, suggests that self-exculpatory cognitive processes are associated with antisocial behavioral tendencies. This implies that when trying to model antisocial behavior, researchers should make sure to account for SSCDs. Also, programs (e.g., DiBiase, Gibbs, Potter, & Blount, 2012; Gibbs, Potter, & DiBiase, in press) aimed at reducing antisocial behavior should take a cognitive-behavioral approach that specifically addresses the cognitive frameworks associated with offending.

In regards to vmPFC function, the current research failed to show any neural correlation with antisocial behavior. These results are inconsistent with previous findings and call for future research to clarify this discrepancy. These additional studies are necessary to understand if atypical cortical development of the vmPFC influences, or even facilitates, antisocial behavioral tendencies in non-clinical populations. Finally, the lack of correlation between vmPFC function and SSCDs encourages future studies to evaluate and identify neurological anchors of SSCDs. Once functional neural correlates of SSCDs are established, we can investigate whether programs that remediate SSCDs improve functioning in these regions.
In closing, this was the first study to incorporate and interrelate SSCDs, vmPFC function, and antisocial behavior in one empirical analysis. Although a relationship between vmPFC function and SSCDs was not found, we hope that this study will encourage other researchers to interrelate neurobiological and cognitive processes associated with antisocial behavior. Only when we understand how these processes are interrelated can we develop a more comprehensive account of the development of antisocial behavior.
References


Appendix A: The How I Think Questionnaire

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Appendix B: Interpersonal Reactivity Index – Full Scale

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate letter on the scale at the top of the page: A, B, C, D, or E. When you have decided on your answer, fill in the letter on the answer sheet next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

ANSWER SCALE:

A               B               C               D               E

DOES NOT DESCRIBES ME
DESCRIBE ME     VERY
WELL            WELL

1. I daydream and fantasize, with some regularity, about things that might happen to me. (FS)
2. I often have tender, concerned feelings for people less fortunate than me. (EC)

3. I sometimes find it difficult to see things from the “other guy’s” point of view. (PT)
   (-)

4. Sometimes I don’t feel very sorry for other people when they are having problems.
   (EC) (-)

5. I really get involved with the feelings of the characters in a novel. (FS)

6. In emergency situations, I feel apprehensive and ill-at-ease. (PD)

7. I am usually objective when I watch a movie or play, and I don’t often get completely caught up in it. (FS) (-)

8. I try to look at everybody’s side of a disagreement before I make a decision. (PT)

9. When I see someone being taken advantage of, I feel kind of protective towards them. (EC)

10. I sometimes feel helpless when I am in the middle of a very emotional situation.
    (PD)
11. I sometimes try to understand my friends better by imagining how things look from their perspective. (PT)

12. Becoming extremely involved in a good book or movie is somewhat rare for me.
   (FS) (-)

13. When I see someone get hurt, I tend to remain calm. (PD) (-)

14. Other people’s misfortunes do not usually disturb me a great deal. (EC) (-)

15. If I’m sure I’m right about something, I don’t waste much time listening to other people’s arguments. (PT) (-)

16. After seeing a play or movie, I have felt as though I were one of the characters. (FS)

17. Being in a tense emotional situation scares me. (PD)

18. When I see someone being treated unfairly, I sometimes don’t feel very much pity for them.
   (EC) (-)

19. I am usually pretty effective in dealing with emergencies. (PD) (-)
20. I am often quite touched by things that I see happen. (EC)

21. I believe that there are two sides to every question and try to look at them both. (PT)

22. I would describe myself as a pretty soft-hearted person. (EC)

23. When I watch a good movie, I can very easily put myself in the place of a leading character. (FS)

24. I tend to lose control during emergencies. (PD)

25. When I’m upset at someone, I usually try to “put myself in his shoes” for a while. (PT)

26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me. (FS)

27. When I see someone who badly needs help in an emergency, I go to pieces. (PD)

28. Before criticizing somebody, I try to imagine how I would feel if I were in their place. (PT)
NOTE: (-) denotes item to be scored in reverse fashion

PT = perspective-taking scale
FS = fantasy scale
EC = empathic concern scale
PD = personal distress scale

A = 0
B = 1
C = 2
D = 3
E = 4

Except for reversed-scored items, which are scored:

A = 4
B = 3
C = 2
D = 1
E = 0
Appendix C: Adult Self-Report Questionnaire

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Appendix D: Reactive – Proactive Aggression Questionnaire
Instructions:
There are times when most of us feel angry, or have done things we should not have done. Rate each of the items below by putting a circle around 0 (never), 1 (sometimes), or 2 (often). Do not spend a lot of time thinking about the items – just give your first response. Make sure you answer all the items (see below)

How often have you...

1. Yelled at others when they have annoyed you 0 1 2
2. Had fights with others to show who was on top 0 1 2
3. Reacted angrily when provoked by others 0 1 2
4. Taken things from other students 0 1 2
5. Gotten angry when frustrated 0 1 2
6. Vandalized something for fun 0 1 2
7. Had temper tantrums 0 1 2
8. Damaged things because you felt mad 0 1 2
9. Had a gang fight to be cool 0 1 2
10. Hurt others to win a game 0 1 2
11. Become angry or mad when you don't get your way 0 1 2
12. Used physical force to get others to do what you want 0 1 2
13. Gotten angry or mad when you lost a game 0 1 2
14. Gotten angry when others threatened you 0 1 2
15. Used force to obtain money or things from others 0 1 2
16. Felt better after hitting or yelling at someone 0 1 2
17. Threatened and bullied someone 0 1 2
18. Made obscene phone calls for fun
19. Hit others to defend yourself
20. Gotten others to gang up on someone else
21. Carried a weapon to use in a fight
22. Gotten angry or mad or hit others when teased
23. Yelled at others so they would do things for you
Appendix E: Gambling Task Instructions

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Appendix F: Automated Operation – Span Instructions

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Appendix G: Advertisement for Psychology REP

**Study Description:**
In this experiment, participants will be asked to complete computer tasks and fill out questionnaires pertaining to social attitudes, social behavior, and neuropsychological variables. This study requires participation across two study sessions. During the first session, participants will be asked to complete a short series of questionnaires. During the second session, participants will be asked to complete two brief computer tasks.

**Eligibility Requirements:**
- You must be at least 18 years of age
- You must **not** have a previously diagnosed brain injury.
Appendix H: Consent Form
The Ohio State University Consent to Participate in Research

Study Title: Neuropsychological variables, social attitudes, and social behavior
Researcher: John C. Gibbs, Ph.D.

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.

Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
In this study, we are investigating possible relationships between neuropsychological variables, social attitudes, and social behavior. You are being asked to participate in this research study because your feedback will help us learn more about how neuropsychological factors and social attitudes influence individuals’ social behavior.

Procedures/Tasks:
The study requires you to complete both computer tasks and questionnaires. You will be asked to fill out three questionnaires pertaining to social attitudes and behavior. In addition, you will be instructed to complete two brief computer tasks.

Duration:
It will take approximately 1.5 hours to complete the questionnaires and computer tasks. You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.
Risks and Benefits:
There are no anticipated risks to participating in the study. The results of this experiment will help us gain a better understanding of the dynamics of social behavior.

Confidentiality:
Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:
You will receive 1.5 hours of REP credit for your participation. You will not be paid to participate in the study.

Participant Rights:
You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:
For questions, concerns, or complaints about the study you may contact Dr. John C. Gibbs, by email at gibbs.1@osu.edu or by phone at (614) 292-5303 or Matthew Blount by email at blount.37@osu.edu.
For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Dr. John C. Gibbs, by email at gibbs.1@osu.edu or by phone at (614) 292-5303 or Matthew Blount by email at blount.37@osu.edu.

**Signing the consent form**

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

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**Investigator/Research Staff**

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

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Appendix I: Debriefing Document

Debriefing Statement

Thank you for participating. The goal of this project is to study possible relationships between neuropsychological variables, social attitudes, and social behavior. We are interested in how your responses on the computer tasks relate to your responses on the self-report measures. If you have any questions about this research, please contact Dr. John Gibbs: gibbs.l@osu.edu.