

**Examining Executive Function and Empathetic Processing in Disinhibited Populations  
Using the Social Simon Task**

Rebecca Spaulding

Advised by: Dr. Arielle Baskin-Sommers

Senior Essay in Cognitive Science

Yale University

### **Abstract**

There are many forms of disinhibitory psychopathology, two of which are psychopathy and externalizing disorders. Although there is still much to be discovered about the cognitive deficits that underlie these psychopathologies, recent research indicates that attention and executive function play important roles in leading to antisocial behavior. Specifically, psychopathic individuals have attentional deficits that result in a failure to attend peripheral information and externalizing individuals have deficits in executive function that result in a failure to control antisocial behavior. These distinct cognitive deficits lead to disinhibited behavior in both populations in different ways. Additionally, research suggests that psychopathic and externalizing individuals also differ in how they process and experience empathy.

This study conducted the Social Simon task with a disinhibited sample to explore the intersection of mechanisms of disinhibition and empathetic processing. Consistent with previous literature and our hypotheses, this study found that 1- psychopathic individuals fail to spontaneously take on another's perspective, but psychopathic individuals who engage in perspective-taking do, and 2- externalizing individuals do spontaneously take on another's perspective and externalizing individuals who engage in perspective-taking are even further affected by another's presence. Moreover, these results support previous findings that the Social Simon task does measure empathetic processing, specifically perspective-taking.

## **I. Introduction**

### ***Disinhibitory Psychopathology***

Disinhibitory psychopathology encompasses several behavioral disorders and can be broken down into distinct conceptualizations. Two specific disorders marked by disinhibited traits and behaviors are psychopathy and externalizing disorders. Individuals with psychopathy are identified by superficial and shallow affective experience, impulsive and irresponsible behavior, difficulty forming genuine relationships with others, and a chronic antisocial lifestyle that leads to significant burdens to the individual and society. In contrast, externalizing individuals are characterized by intense hostility and reactive aggression, poor impulse control, hypersensitivity to rewards (e.g. money), and excessive reward-seeking behavior. Externalizing disorders are a much more heterogeneous mix of disorders than psychopathy, and include conduct disorder, substance use disorders, and antisocial personality disorder (Baskin-Sommers & Newman, 2013). Since impulsive and antisocial lifestyle traits apply to both psychopathy and externalizing disorders, the two groups of disinhibitory psychopathology are most clearly distinguished by the presence of callous-unemotional traits in psychopathic individuals.

Psychopathy affects approximately 1% of the general population of 25% of incarcerated male prisoners (Hare, 2006; Hare & Neumann, 2010). Due to the heterogeneous nature of the externalizing spectrum, rates of externalizing disorders in incarcerated populations are much higher than rates of psychopathy; an estimated 50-80% of incarcerated male offenders have antisocial personality disorder (Baskin-Sommers & Newman, 2013).

### ***Assessing Psychopathy and Externalizing Disorders***

The overlapping behavior problems of individuals with psychopathic and externalizing traits complicate the issue of accurately diagnosing individuals. Psychopathy is typically

assessed through a semi-structured interview and scoring of the Psychopathy Checklist-Revised (PCL-R) (Hare, 2003). The PCL-R consists of 20 items, and each can be rated 0, 1, or 2, with 0 being the least severe rating for a trait and 2 being the most severe. The 20 traits assessed in the PCL-R can be divided into a two-factor model of psychopathy. Factor 1 items assess interpersonal and affective traits, including glibness/superficial charm, grandiose sense of self-worth, shallow affect, callous/lack of empathy, and failure to accept responsibility. Factor 2 items assess behavior and lifestyle, including poor behavioral controls, boredom/need for stimulation, lack of realistic long-term plans, irresponsibility, and juvenile delinquency. There is substantial overlap between factor 2 items and measures of externalizing and antisocial personality disorder.

In contrast, due to the heterogeneous mix of externalizing disorders, a number of measures are used to assess externalizing behavior. One way to identify externalizing behavior is by assessing individuals for conduct disorder, adult antisocial behavior, and substance disorders and finding the common variance associated with all of them (Iacono et al., 2008). Another way is to use self-report questionnaires that assess personality traits and temperament related to externalizing—namely, low constraint, impulsivity, negative emotionality, high extraversion, and high neuroticism. Two such questionnaires are the Multidimensional Personality Questionnaire (MPQ) and the Externalizing Spectrum Inventory (ESI) (Patrick, Curtin, & Tellegen, 2002; Krueger, Markon, Patrick, Benning, & Kramer, 2007).

### ***Processes Related to Disinhibitory Psychopathology***

Although the disinhibited behaviors of psychopathy and externalizing disorders are very similar, there is ample evidence to suggest that there are distinct dysfunctional cognitive-

affective interactions associated with each, particularly in the domains of attention and executive function.

### *Abnormalities in Attention*

In the domain of attentional processes, one theory is that psychopathic individuals suffer from an early attention bottleneck that results in difficulty allocating equal attention to goal-directed information and peripheral, but potentially important, information. Due to their difficulty in processing both goal-directed and peripheral information, psychopaths suffer from a bias that makes them unaware and unresponsive to information that is less relevant to their goals (Baskin-Sommers & Newman, 2013). As a result, the emotional and inhibitory deficits commonly thought of as core psychopathic traits may be moderated by attentional focus. With regard to emotion deficits, Newman, Curtin, Bertsch, and Baskin-Sommers (2010) found that psychopaths demonstrate a deficit in fear potentiated startle when threat-relevant cues were peripheral to their central focus of attention, but that this deficit disappears in conditions in which psychopaths focus their attention on the threat-relevant cues of stimuli. Newman and colleagues also found that another quintessential deficit of psychopathy—a deficit in inhibiting punished responses—is also moderated by attentional focus. In a go-nogo task when psychopaths were focused on the primary goal of earning rewards (and avoiding punishment was peripheral to this goal), they showed worse performance at inhibiting punished responses than controls, but when they were focused only on avoiding punishment, there were no significant differences between psychopaths and normal controls (Newman & Kosson, 1986).

However, externalizing individuals show different attention-related deficits; they are primed to over-allocate attention towards motivationally significant information, which impairs other processes of executive control and causes emotional hyper-reactivity. Individuals with high

externalizing show clearly differentiated performance from psychopaths in instructed fear paradigms (Baskin-Sommers, Curtin, and Newman, 2011).

Psychopaths and externalizers show distinct attentional-deficits. Psychopaths have an attentional bottleneck that blocks the processing of peripheral information that is not goal-relevant. In contrast, externalizers show a deficit in the later stages of attention processing and over-allocate attentional resources to emotionally salient information at the expense of processing other goal-relevant information which may be crucial for self-regulation.

#### *Abnormalities in Executive Function and Inhibition*

Psychopaths' attentional bottleneck filters out peripheral information at an early stage of information processing, resulting in fewer demands on processing and fewer demands for executive control. As a result, they do not tend to show deficits on executive functioning tasks, and in some cases, show superior performance on executive functioning tasks compared to normal controls. For example, on Stroop-like tasks that separate goal-relevant information, psychopathic individuals show significantly less interference than non-psychopathic individuals (Hiatt et al., 2004, Newman, Schmitt & Voss, 1997, Vitale, Brinkley, Hiatt & Newman, 2007).

Evidence from behavioral and imaging studies has clearly shown that externalizing individuals have impaired executive functioning (Iacono, Malone, & McGue, 2008), but the connection between externalizers' deficits in attention allocation and executive function is less clear. One hypothesis is that when externalizers anticipate motivationally significant information and over-allocate attentional resources towards that expectation, the over-allocation impairs executive functions of inhibition and control (Baskin-Sommers & Newman, 2013).

At the mechanistic level, one process of particular research interest in psychopathic and externalizing individuals is inhibition. In tasks measuring inhibitory control, psychopaths show

normal or superior performance and externalizers show severe deficits in performance, but in daily functioning and social interactions, both populations exhibit disinhibited behavioral problems. The differences in inhibitory control tasks and similarities in real world disinhibited behaviors between psychopaths and externalizers can be explained by their respective cognitive-emotional deficits. In inhibitory control tasks, psychopaths' attention deficit allows them to focus on goal-directed behavior and resist interference from peripheral information, resulting in normal, and sometimes superior, performance on these tasks. Externalizers' deficits in executive function result in increased interference from peripheral information and diminished performance on inhibitory control tasks.

Disinhibited and antisocial behaviors in social interactions can be explained by these same deficits. For externalizers, deficits in executive function lead to a reduced ability to inhibit maladaptive responses, and their executive functioning deficits may be the underlying cause of their emotional hyper-reactivity, excessive drug use, and general disinhibited behavior. For psychopaths, their disinhibited behavior may be explained by the attention bottleneck if the goal-irrelevant information they are filtering out is information about the impulsivity of their behavior. In social interactions, the bottleneck allows them to focus closely on goal-relevant information and filter out peripheral information, such as the harmful consequences of their actions to others. This inattention to the experiences of others may explain their callous and unemotional social interactions with others.

### ***Disinhibitory Psychopathology and Empathy***

Social interactions are heavily dependent on empathy. Empathy is commonly thought of the "reactions of one individual to the observed experiences of another" (Davis, 1980). Similarly to disinhibitory psychopathology, empathy is a multi-faceted concept that can be broken down

into distinct components: cognitive and affective empathy. Cognitive empathy is the ability to construct a working model of the emotional states of others; subtypes include perspective-taking (intuitively putting oneself in another person's shoes to see things from his or her perspective) and online simulation (an effortful attempt to put oneself in another person's position by imagining what the person is feeling). Affective empathy, also called emotional empathy, is the ability to be sensitive to and vicariously experience the feelings of others; subtypes include emotion contagion (the automatic mirroring of others' feelings), proximal responsivity (an affective response when witnessing the mood of others in a close social context), and peripheral responsivity (an affective response when witnessing the mood of others in a detached context) (Reniers, Corcoran, Drake, Shryane, & Völlm, 2011).

Research examining associations between empathy and psychopathic traits yields an interesting pattern of results. There is evidence that the two-factor model of psychopathy described above largely explains psychopaths' results in studies assessing their empathetic responses. Research by Seara-Cardoso, Neumann, McCrory, & Viding (2012) suggests the two factors have opposite relations with emotion and emotional reactivity. In a study examining men with psychopathic traits, they found that factor 1 traits were associated with weaker empathetic responses to stories with positive affect and a lower propensity to feel empathetic concern. In contrast, factor 2 traits were associated with a greater propensity to feel empathetic concern. In a more recent study, Seara-Cardoso, Dolberg, Neumann, Rosier, & Viding (2013) saw a similar pattern in women with psychopathic traits, suggesting that the two dimensions of psychopathic traits and behaviors make distinct contributions to emotional and empathetic processing despite gender differences.

An imaging study by Decety, Chen, Harenski, & Kiehl (2013) provides further evidence that factor 1 traits are associated with reduced empathetic concern. Participants were shown



stimuli of bodily images and in some cases were told to adopt an imagine-self perspective and in others, to adopt an imagine-others perspective. In the imagine-self conditions, individuals high on psychopathy showed the same response as individuals with low and intermediate psychopathy. However, in the imagine-other perspective, individuals high on psychopathy showed reduced arousal. One interpretation of these results is that psychopaths' failure to recruit the same neural circuits as the controls contributes to their lack of empathetic concern. With regard to psychopaths' known attention deficit, it is possible they may have disrupted processing of automated cognitive empathy (i.e. perspective-taking) and affective empathy if the attention bottleneck filters out others' perspectives as goal-irrelevant information.

Less research has been conducted on externalizing disorders and empathetic processing. One study found that 2-year-olds who displayed more externalizing and aggressive behaviors showed shorter latency periods to respond to someone in distress and more overt empathetic responses (Gill & Calkins, 2003). One interpretation of these results is that the shorter latency periods and more overt responses reflect poor social inhibition and emotion regulation, and that in these unknown situations with unfamiliar individuals in distress, a more inhibited (and possibly, appropriate) response would involve less overt behavior. In addition, it is possible that externalizing children may be more responsive and hyper-reactive to the emotions and distress of others due to diminished executive function that makes them more prone to interference by contextual information.

Research on empathetic processing in other types of psychological disorders, such as narcissistic personality disorder, may provide context for generating hypotheses about the role of empathy in externalizers. Narcissistic individuals indicate a deficit in affective empathy, rather than cognitive empathy. Individuals high on narcissistic traits show abnormal brain deactivation when asked to empathize with pictures of people making emotional faces and show deficits in

empathetic concern when exposed to emotionally charged situations (Fan et al., 2011; Ritter et al., 2011). On self-report questionnaires of empathy, narcissistic individuals report low willingness to engage in empathetic concern and overestimate their capacity for emotional empathy (Davis, 1983; Ritter et al., 2011). The limited experimental research in this field currently suggests that narcissistic individuals have the capacity to process affective information but are unwilling to engage in empathetic processing (Baskin-Sommers, Krusemark, & Ronningstam, 2014).

Despite this research on empathetic processing in narcissistic individuals, there is a gap in the literature on disinhibitory psychopathology and empathetic processing. To date, no task-based experimental research has been conducted to examine the intersection of empathetic processing and mechanisms of disinhibition. The Social Simon task provides a novel way to probe the relationship between these two cognitive processes by measuring executive function and a specific type of empathetic response, namely perspective-taking.

### ***Social Simon Task***

The Social Simon task measures both executive function and perspective-taking. The standard Simon effect—also known as the spatial compatibility effect—refers to the phenomenon of faster and more accurate response times to a stimulus when the stimulus is presented in the same physical location as the response. Importantly, the location of the stimulus is irrelevant to the explicit task at hand. In the original version of the standard Simon task, a participant was presented with auditory stimuli to either their left or right ear. The stimuli were the words “left” and “right” and participants were instructed to press a left or right key in response to the words. Participants showed improved reaction times and accuracy rates when the location of the auditory stimuli (i.e. presented to the left or right ear) matched the location of the

key were supposed to respond with (i.e. left or right key). Thus, performance on the task was strongly influenced by a task-irrelevant factor—namely, spatial compatibility between an irrelevant stimulus feature and a relevant response feature (Simon & Rudell, 1967).

The standard Simon effect has also been elicited with visual stimuli. Sebanz, Knoblich, & Prinz (2003) presented participants with images of a hand wearing either a red or green ring. Participants were instructed to press one key in response to a red ring and another key in response to a green ring. The irrelevant spatial stimulus was the direction the hand was pointed—either left, right, or centered (neutral). The participants demonstrated the Simon effect and had faster reaction times when the visual stimulus and instructed response were spatially compatible (i.e. when the hand was pointed at the corresponding key they were supposed to press) and had slower reaction times when the visual stimulus and the instructed response were spatially incompatible (i.e. when the hand was pointed at the key they were not supposed to press).

Sebanz et al. (2003) also developed a novel paradigm for testing the effect of spatial compatibility when performing a task with a partner and found the Social Simon effect. They replicated that in a two-choice response task (i.e. the standard Simon task), participants' performance was affected by spatial compatibility. In an individual go-nogo task in which participants were instructed to respond to only one of the ring colors, the spatial compatibility effect disappeared. Interestingly, the spatial compatibility effect returned in a joint go-nogo task in which participants were instructed to respond to one of the ring colors and a partner participated next to them and was instructed to respond to the other ring color. The presence of a spatial compatibility effect in the joint go-nogo task was labeled as the Social Simon effect, and it suggests that in a healthy population, subjects represent their own actions and the actions of others as functionally equivalent. In other words, subjects are engaging in some form of

spontaneous perspective-taking and are representing another person's actions and goals, even when it is irrelevant to their own actions and goals in the task at hand.

The Social Simon effect is very robust and has been found with a variety of stimuli and partners for the task. There are two main areas of debate surrounding the Social Simon effect. First, there are mixed findings on whether the belief that another person is responding to the task is sufficient to produce the effect or if the other person must be visually present to elicit the effect, and to what degree. Tsai, Kuo, Hung, & Tzeng (2008) brought in pairs of familiar individuals and had them perform joint go-nogo tasks in separate rooms. The participants were told they were either playing with their acquaintance or a computer; in reality, all responses were produced by a computer. They observed the Social Simon effect when participants believed they were playing against another human, despite any auditory or visual feedback that the responding agent was actually a human. In addition, participants have also demonstrated the Social Simon effect in response to auditory stimuli when they were blindfolded (and thus had no visual input of their partner's actions) and when they were blindfolded and using soundless keyboards (and thus had no visual or auditory input of their partner's actions) (Vlainic, Liepelt, Colzato, Prinz, & Hommel, 2010). Together, these results have been taken to suggest the social Simon effect does not rely on online visual or auditory information about another's actions and can be elicited by simply the belief that one is responding with a human agent.

Welsh, Higgins, Ray, & Weeks (2007) replicated Sebanz et al.'s (2003) findings that the spatial compatibility effect existed in the standard Simon task and a joint go-nogo task with a confederate by their side. However, they did not find an effect of spatial compatibility when the confederate told the participant she would continue responding to the joint go-nogo task in another room, despite participants reporting that they believed she was responding from the other room. These results suggest that co-representation of another's actions and perspective only

occurs when participants have some degree of visual contact with the responding agent. Moreover, Guagnano, Rusconi, & Umiltà (2010) found that the Social Simon task was only elicited when partners were in each other's peripersonal space (i.e. within arm-reach) and claimed that visual contact with a responding agent is not sufficient to produce the Social Simon effect, but that the agent must be within one's peripersonal space in order to provide a reference point for representing their actions.

There has been some research conducted on psychopaths' performance on the standard Simon task. Müller, et al. (2008) showed psychopaths and normal controls images with positive, negative or neutral affect before spatially compatible or incompatible stimulus-response trials in the standard Simon task. Emotion induction had no impact on performance on compatible trials for either group. For controls, there was a significant interaction effect of negative emotion for the more cognitively demanding incompatible trials; their error rates were significantly higher after being exposed to negative affect images than for positive or neutral affect images. In contrast, negative emotion had no impact on psychopaths' performance during incompatible trials. These results support the hypothesis that psychopaths have impaired integration of emotion and cognition, which can lead to superior performance on cognitively demanding tasks. Empathy may play a key role in explaining why individuals with psychopathy are able to resist the impact of social context and why externalizing individuals react strongly to social contexts.

## **II. Current Study**

To date, no study has examined the impact of social context on executive function in psychopathic and externalizing individuals, despite the potential association between their respective disinhibited processes and behavioral disinhibition. The Social Simon task provides a way to test both executive function and empathetic processing in these populations due to the

potential for spatial compatibility effects to appear in three different tasks: a Basic Simon task, a Individual Go-Nogo task, and a Joint Go-Nogo task.

Our hypothesis is that due to their goal-oriented behavior and lack of attention to peripheral stimuli, psychopathic individuals will not show spatial compatibility effects when another person joins them in the Joint Go-Nogo task. In contrast, externalizing individuals will show compatibility effects when another person joins them because the presence of another person will add a social affective component and place added demand on their executive function. Moreover, we expect that empathetic processing, specifically perspective-taking, will moderate the relationship between disinhibitory psychopathology and task performance, such that individuals who score high on measures of perspective-taking will show compatibility effects in Joint Go-Nogo.

### **III. Method**

#### ***Participants***

Forty-seven participants were recruited from the New Haven community to participate in the study by posting flyers in specific areas of town and snowball sampling. Individuals were excluded if they met any of the following exclusion criteria: younger than 18 years old or older than 55 years old, uncorrectable auditory or visual deficits, English as a secondary language, less than a fourth grade English reading level, estimated IQ less than 70, head injury with loss of consciousness for more than 30 minutes or with lasting effects, epilepsy, more than three substance-induced seizures, stroke, chronic medical disease (e.g. cancer, multiple sclerosis, diabetes, hepatitis, HIV+/AIDS), family history of schizophrenia/psychosis/bipolar disorder with psychosis/depression with psychotic features in a first-degree relative, pervasive developmental disorder, any other neurological disorder not otherwise specified, thyroid disorder (if not stable

for more than two years), schizophrenia or other psychotic disorder, depression or anxiety disorder in the past six months, tricyclic or antipsychotic medications, or metal implants in eyes or head. The exclusion of major psychopathology and IQ lower than 70 was used to reduce the contributions of these extraneous influences on the interview and psychological assessments.

Sample characteristics can be found in Table 1.

### ***Measures***

#### *The Self-Report Psychopathy Scale, version III (SRP-III)*

The Self-Report Psychopathy Scale (Paulhus, Hemphill, & Hare, 2007) is a 64-item measure looking at four subscales of psychopathic behavior: Interpersonal Manipulation (IPM), Callous Affect (CA), Erratic Life Style (ELS), and Anti-Social Behavior (ASB). Participants are asked to rate the degree to which they agree with each statement using a 5-point Likert scale, where 1 means “Disagree Strongly” and 5 means “Agree Strongly”. To score, the 16 items in each subscale are summed to get the mean. The overall SRP-III score is the mean of the four subscales. A higher score indicates a greater level of psychopathic behavior. Total scores range from 4-20.

#### *The Externalizing Spectrum Inventory-Brief (ESI-Brief)*

The Externalizing Spectrum Inventory-Brief is a 100-item self-report measure that assesses a range of behavioral and personality characteristics associated with the externalizing spectrum of psychopathology on both broad- and individual-factor levels (Hall, Bernat, & Patrick 2007). Participants are asked to choose which option describes them best in regard to each statement: True (1), Mostly True (2), Mostly False (3), or False (4). Of the 18 subscales, examples include: alcohol problems, externalization, boredom proneness, drug use, and empathy. Each is scored as

an average of the questions asked within that facet, with higher scores indicating greater levels of externalizing. Total scores range from 100-400.

### *The Questionnaire of Cognitive and Affective Empathy (QCAE)*

The Questionnaire of Cognitive and Affective Empathy is a 31-item self-report measure of two distinct dimensions of empathy: cognitive empathy and affective empathy (Reniers et al., 2011). Cognitive empathy is defined as the ability to construct a working model of the emotional states of others, and affective empathy is defined as the ability to be sensitive to and vicariously experience the feelings of others. All 31 items are answered on a 4-point Likert scale ranging from “Strongly disagree” (1) to “Strongly agree” (4). The measure has five subscales, each made up of a varying number of items. The two subscales of cognitive empathy are: perspective-taking (“intuitively putting oneself in another person’s shoes to see things from his or her perspective”) and online simulation (“an effortful attempt to put oneself in another person’s position by imagining what that person is feeling”). The three subscales of affective empathy are: emotion contagion (“the automatic mirroring of the feelings of others”), proximal responsiveness (one of two responsiveness aspects of empathetic behavior, “specifically the affective response when witnessing the mood of others in a close social context”), and peripheral responsiveness (the second responsiveness aspect of empathetic behavior, “specifically the affective response when witnessing the mood of others in a detached context”).

### ***Procedure***

A phone screen of mental health history, criminal history, and current functioning was used to conduct a preliminary analysis of eligibility for the study. After the initial phone screen, participants were assessed using an extensive clinical assessment battery consisting of the



Structured Clinical Interview for DSM-IV Disorders (SCID) and a neuropsychological battery comprised of the Shipley, the WRAT, the WAIS, the Trail Making Test, and the Stroop Test (Zachary, 1986; Wilkinson, 1993; Weschler, 1997). Participants also filled out a number of questionnaires assessing personality, behavior, and empathy, including the three questionnaires described above, on a computer in the lab. Participants came in for a separate session to participate in the Social Simon task. All participants performed the same three tasks in the same order: a Basic Simon task, an Individual Go-Nogo task, and a Joint Go-Nogo task.

### ***Task Description***

The Social Simon task consists of three separate tasks: a Basic Simon task, an Individual Go-Nogo task, and a Joint Go-Nogo task.

In the Basic Simon task, participants sat in front of a computer screen and keyboard and viewed red and green squares appear on the screen. They were instructed to press the left shift key when they saw a green button and to press the right shift key when they saw a red square (See *Figure 1*). In the Individual Go-Nogo task, participants were instructed to respond only to green squares by pressing the right shift key with their dominant hand (See *Figure 2*). In the Joint Go-Nogo task, a confederate matched to the participant's gender entered the room and sat to the left of the participant. Again, the participant was instructed to respond only to green squares by pressing the right shift key with their dominant hand. The confederate was instructed to respond only to red squares by pressing the left shift key with their dominant hand (See *Figure 3*).

Each of the three tasks had four blocks of trials with 30 seconds of rest between each block. Each block consisted of 60 trials, with 30 green squares and 30 red squares appearing in the left, right, or center of the screen ten times each. The order the squares appeared in was

randomized. The inter-trial interval ranged from 1-3 seconds, split evenly in increments of .5 seconds. The experimenter returned to the testing room after the end of each task to give the instructions for the next task. Before each task, the experimenter emphasized that the participant should attempt to respond as quickly and accurately as possible. Each task lasted for 13 minutes.

#### **IV. Results**

Data from 47 participants was analyzed. The data of 3 participants was removed from analysis based on experimenter observations of them falling asleep or being inattentive during the task. Only data from trials in which the participant responded to the stimulus correctly was analyzed.

##### ***Task Results***

*Basic Simon vs. Joint Go-Nogo.* Reaction time data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) General Linear Model (GLM). Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible).

There was a significant omnibus effect of task type such that reactions times were slower in Basic Simon than in Joint Go-Nogo,  $F(1,46)=210.14, p=.000, \eta p^2=.820$ . There was a significant effect of compatibility such that RTs were slower for incompatible trials than compatible trials,  $F(1,46)=91.77, p=.000, \eta p^2=.666$ , and were significantly slower for neutral trials than compatible trials,  $F(1,46)=8.14, p=.006, \eta p^2=.150$ .

There was a significant interaction between task type and compatibility such that the difference in RT between incompatible and compatible trials was larger in Basic Simon than in Joint Go-Nogo,  $F(1,46)=11.01, p=.002, \eta p^2=.193$ , and the difference in RT between neutral and

compatible trials was also larger in Basic Simon than in Joint Go-Nogo,  $F(1,46)=16.92$ ,  $p=.000$ ,  $\eta p^2=.269$ .

*Individual Go-Nogo vs. Joint Go-Nogo.* A second 2 (task type: Individual Go-Nogo, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM was conducted to analyze reaction times. Again, interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible).

There was a significant omnibus effect of task type such that RTs were slower in Individual Go-Nogo than in Joint Go-No,  $F(1,46)=26.83$ ,  $p=.000$ ,  $\eta p^2=.364$ . There was also a significant effect of compatibility such that RTs were lower for incompatible trials than compatible trials,  $F(1,46)=16.67$ ,  $p=.000$ ,  $\eta p^2=.266$ .

Moreover, there was a significant interaction between task type and compatibility where the difference in RT between incompatible and compatible trials was bigger in Joint Go-Nogo than in Individual Go-Nogo, suggesting that meaning that stimulus-response compatibility affected performance more in Joint Go-Nogo than in Individual Go-Nogo,  $F(1,46)=9.72$ ,  $p=.003$ ,  $\eta p^2=.174$ .

### ***Individual Differences in Psychopathy***

*Basic Simon vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with SRP-III (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible).

When psychopathy was included in the analysis, the main effects of task, compatibility and the interaction between task and compatibility that were found in the overall task results

were still significant. There was a significant Task x Compatibility x Psychopathy interaction contrast,  $F(1,45)=4.08$ ,  $p=.049$ ,  $\eta p^2=.083$ . Individuals higher on psychopathy were faster on compatible versus neutral trials in Basic Simon but not in Joint Go-Nogo.

*Individual Go-Nogo vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Individual Go-Nogo, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with SRP-III (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible).

The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant. There were no significant two or three-way interactions with psychopathy.

### ***Individual Differences in Psychopathy with Theory of Mind as a Moderator***

*Basic Simon vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with SRP-III (z-score) and QCAE Perspective-taking subscore as continuous factors. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant.

There was a significant Compatibility x Psychopathy x Perspective-taking interaction contrast,  $F(1,39)=5.73$ ,  $p=.022$ ,  $\eta p^2=.128$ . Individuals high on psychopathy and perspective-taking were faster on compatible versus neutral trials in both Basic Simon and Joint Go-Nogo.

*Individual Go-Nogo vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with SRP-III (z-score) and QCAE Perspective-taking subscore as continuous factors. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant.

There was a significant Task x Compatibility x Psychopathy x Perspective-taking interaction contrast,  $F(1,39)=4.26$ ,  $p=.046$ ,  $\eta p^2=.099$ . Individuals higher on psychopathy and perspective-taking were slower in Joint Go-Nogo ( $B=.013$ ,  $p=.321$ ) than Individual Go-Nogo ( $B=.003$ ,  $p=.801$ ) for incompatible versus compatible trials.

### ***Individual Differences in Externalizing***

*Basic Simon vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with ESI (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant.

There was a significant Task x Externalizing interaction such that individuals higher on externalizing were faster in Basic Simon and slower in Joint Go-Nogo,  $F(1,45)=7.32$ ,  $p=.010$ ,  $\eta p^2=.140$ .

*Individual Go-Nogo vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Individual Go-Nogo, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with

ESI (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant. There were no significant two or three-way interactions with externalizing.

### ***Individual Differences in Externalizing with Theory of Mind as a Moderator***

*Basic Simon vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Basic Simon, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with ESI (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant.

There was a significant Task x Compatibility x Externalizing x Perspective-taking omnibus interaction such that individuals high on externalizing and perspective-taking were faster for compatible versus incompatible trials in Joint Go-Nogo but not in Basic Simon,  $F(1,39)=6.42, p=.015, \eta p^2=.141$ .

*Individual Go-Nogo vs. Joint Go-Nogo.* Data were examined in a 2 (task type: Individual Go-Nogo, Joint Go-Nogo) by 3 (compatibility: incompatible, neutral, compatible) GLM with ESI (z-score) as a continuous factor. Interaction contrasts were used to examine compatibility effects (e.g. incompatible vs. compatible, neutral vs. compatible). The main effects of task, compatibility and the interaction between task and compatibility found in the overall task results were still significant.

There was a significant Task x Compatibility x Externalizing x Perspective-taking omnibus interaction such that individuals high on externalizing and perspective-taking were slower in Joint Go-Nogo than Individual Go-Nogo for incompatible versus compatible trials,  $F(1,39)=7.44, p=.010, \eta p^2=.16$ .

## **V. Discussion**

The Social Simon task measures mechanisms of executive function and empathetic processing. The instructions to hold two rules in mind and respond appropriately in the Basic Simon task and the instructions to inhibit a response in the Go-Nogo task measure executive function. The presence of another person with their own goals and instructions in the Joint Go-Nogo task measures empathetic processing, specifically perspective-taking.

### ***Task Effects***

The overall task effects are not quite consistent with previous literature on the Social Simon effect. Previous studies found that participants were faster in the Individual Go-Nogo task than in the Basic Simon task (due to the reduced cognitive load of only keeping one rule in mind) and slower in Joint Go-Nogo than in the Individual Go-Nogo task (due to the added cognitive load of a second rule that comes from taking on another person's perspective). In this study, participants were faster in Joint Go-Nogo than Basic Simon and faster in Joint Go-Nogo than Individual Go-Nogo. One possible reason for this may be that for this sample of participants (i.e. chronic drug users, individuals with poor behavioral controls, lower IQ), experience and practice with a task matter more than they do for the normal populations tested in previous Social Simon studies.

The compatibility effects were consistent with previous literature on the Social Simon task. Previous studies found that participants were faster to respond for compatible trials (i.e. when the stimulus location and response location were on the same side) than they were to respond to neutral (i.e. when the stimulus appeared in the middle of the screen) or incompatible trials (i.e. when the stimulus location and response location were on opposite sides). In this study, participants were faster to respond on compatible trials versus neutral or incompatible trials. Overall, the task results suggest that although this sample of participants may have difficulty with cognitive control and general task performance in the Social Simon task, they are still subject to effects of stimulus-response compatibility.

### ***Individual Differences in Psychopathy and Empathy***

The finding that individuals higher on psychopathy were faster on compatible versus neutral trials in Basic Simon but not in Joint Go-Nogo shows that for these individuals, the effect of compatibility is greatly reduced in the Joint Go-Nogo task. In previous findings with healthy controls, the effect of compatibility that disappeared in the Individual Go-Nogo task reappears in the Joint Go-Nogo task, presumably because participants internalize the confederate's rule and have increased cognitive load. However, the disappearance of compatibility effects in Joint Go-Nogo for individuals high on psychopathy suggests that unlike healthy controls, they are not spontaneously taking on another's perspective and internalizing a second rule, which is consistent with the overall literature on psychopaths' failure to spontaneously adopt other viewpoints and empathize with others.

Our hypothesis was that although overall psychopathic individuals would not take on the confederate's perspective in Joint Go-Nogo and thus, would not be subject to effects of compatibility, psychopathic individuals who engaged in perspective-taking would be more likely



to take on the confederate's perspective and thus, show effects of compatibility. The findings from comparisons of performance in Basic Simon vs. Joint Go-Nogo and Individual Go-Nogo vs. Joint Go-Nogo confirmed this. Individuals high on psychopathy and perspective-taking showed compatibility effects in both Basic Simon and Joint Go-Nogo, suggesting that they are taking on the confederate's perspective in Joint Go-Nogo and internalize a second rule just as they do in Basic Simon when they are explicitly given two rules. Furthermore, individuals high on psychopathy and perspective-taking showed compatibility effects in Joint Go-Nogo but not in Individual Go-Nogo, adding further evidence that compatibility does not matter when they perform the task alone but does matter in the presence of another individual, presumably because they are adopting the confederate's perspective and representing two rules simultaneously as normal participants do.

### ***Individual Differences in Externalizing and Empathy***

The finding that individuals high on externalizing were overall slower in the Joint Go-Nogo task is consistent with our hypothesis that the presence of another person with distinct goals and instructions would further diminish externalizers' cognitive control. In addition, we hypothesized that externalizing individuals who scored high on measures of perspective-taking would be subject to compatibility effects in the Joint Go-Nogo task. We found that individuals high on externalizing and perspective-taking showed an effect of compatibility in Joint Go-Nogo but not in Basic Simon, suggesting that the presence of another person and their rule makes compatibility even more salient than when these individuals are explicitly given two rules. Moreover, individuals high on externalizing and perspective-taking showed larger compatibility effects in Joint Go-Nogo than Individual Go-Nogo. Taken together, these findings support the hypothesis that in general, externalizing individuals are very affected by the presence of another

individual, as evidenced by their overall slower RTs in Joint Go-Nogo, and that externalizing individuals who engage in perspective-taking adopt the viewpoint of a confederate and as a result, show compatibility effects in Joint Go-Nogo although the participants have the same goals and instructions that they did in Individual Go-Nogo.

In summary, the results of this study support the initial hypothesis that: 1-overall, individuals higher on psychopathy would not show diminished performance or compatibility effects in Joint Go-Nogo relative to Individual Go-Nogo, 2- overall, individuals higher on externalizing would show diminished performance or compatibility effects in Joint Go-Nogo relative to Individual Go-Nogo, 3- empathetic processing, specifically perspective taking, would moderate the effects of disinhibitory psychopathology such that disinhibited individuals—including those high on psychopathy—who engaged in perspective-taking would show compatibility effects in the Joint Go-Nogo task.

The implications of these results are two-fold. First, these results support previous claims that the Social Simon task assesses an individual's propensity to adopt another's perspective. Second, the results support previous claims about the specific disrupted mechanisms in psychopathy and externalizing by showing psychopaths are less likely to take on others' perspectives and be affected by their presence and externalizers are more likely to show diminished performance in the presence of others with distinct goals.

### ***Limitations***

This was the first study to conduct the Social Simon task with disinhibited populations. One important limitation for this sample of participants may be the lack of practice trials in the experiment. In general, this is a very vulnerable group of participants with chronic drug use and typically limited experience with computers. There are a number of factors that could make

experience with the Social Simon task a very important role in improving their performance. The lack of practice trials could explain why participants in this study were faster in Joint Go-Nogo than Basic Simon or Individual Go-Nogo. Joint Go-Nogo was always the third and final task, and they had the most experience with the task by the time Joint Go-Nogo was conducted.

Another limitation may be the characteristics of the confederate. Although confederates were gender-matched to each participant, they were not matched for age or ethnicity. It is possible that the more similar the confederate is to the participant, the more likely it is the participant will spontaneously adopt their perspective and show compatibility effects in Joint Go-Nogo. Although we found significant compatibility effects in Joint Go-Nogo for both individuals high on psychopathy and externalizing without matching confederates for age and ethnicity, it is possible that doing so would elicit even more pronounced results.

### ***Future Directions***

Since this is the first study to conduct the Social Simon task with disinhibited populations, there are many follow-up studies that should be conducted. First, there could be a follow-up study with practice trials to address the limitation described above. Second, there could be several manipulations to the directions to see if explicit instructions to ignore or attend to the confederate's instructions affect perspective-taking. In the current study, the experimenter gave the confederate their instructions in the presence of the participant. Future studies could have the experimenter: 1- explicitly tell the participant to listen to the confederate's instructions and keep them in mind, 2- explicitly tell the participant to ignore the confederate's instruction and only focus on their rule, 3- do not give the confederate instructions in the presence of the participant. Each of these manipulations has the potential to alter participants' perspective-taking and provide more insight into the mechanisms of empathetic processing.

## **VI. Conclusion**

This study is one of the first to examine empathetic processing in disinhibited populations through task-based experimental research. Using experiential tasks helps to more precisely identify specific mechanisms involved in the cognitive processes of disinhibitory psychopathology. This study found that, consistent with previous literature, 1- psychopathic individuals fail to spontaneously take on another's perspective, but psychopathic individuals who engage in perspective-taking do, and 2- externalizing individuals do take on another's perspective and show diminished performance as a result, and externalizing individuals who engage in perspective-taking are even further affected by another's presence. Moreover, these results indicate the Social Simon task does measure empathetic processing, specifically perspective-taking.

Disinhibited behavior can manifest itself in a number of ways that are harmful to society—impulsivity, substance abuse, incarceration, and violent behavior—and researching the cognitive and emotional deficits that underlie disinhibited behavior is crucial for better understanding these problems and developing effective treatment that targets the specific deficits of psychopathological disorders. Being able to effectively treat individuals with disinhibitory psychopathology has the potential to reduce rates of crime, arrest, recidivism, and substance abuse and save billions of dollars per year. This study highlights the importance of empathetic processing in antisocial individuals and sheds light on how empathy may play a key role in psychopathic individuals' ability to resist the impact of social context and externalizing individuals' strong reactivity to social contexts.

## Appendix

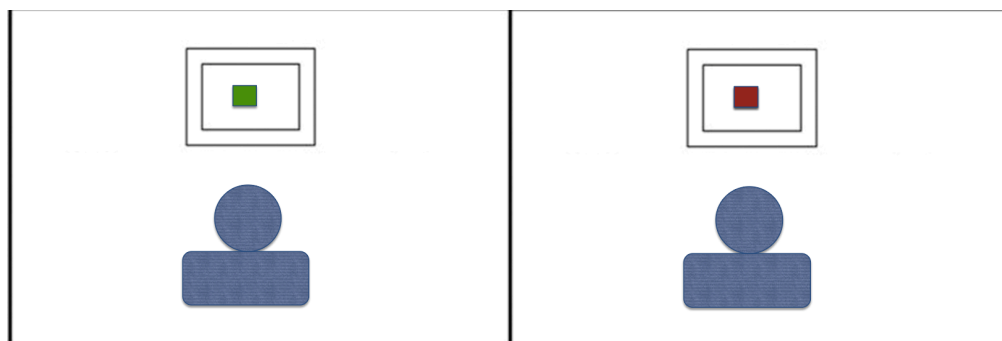
*Table 1.*

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	47	18.00	56.00	37.6596	10.63276
Sex of Participant	47	0	1	.21	.414
Shipley Full Scale IQ	47	82.00	123.00	106.2340	10.33612
WRAT Grade Level	46	6	12	10.87	1.614
Valid N (listwise)	46				

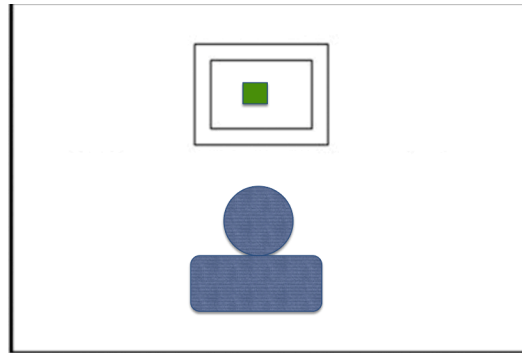
*Figure 1.* Basic Simon task

In the Basic Simon task, the participant is instructed to press two different buttons in response to green and red squares.



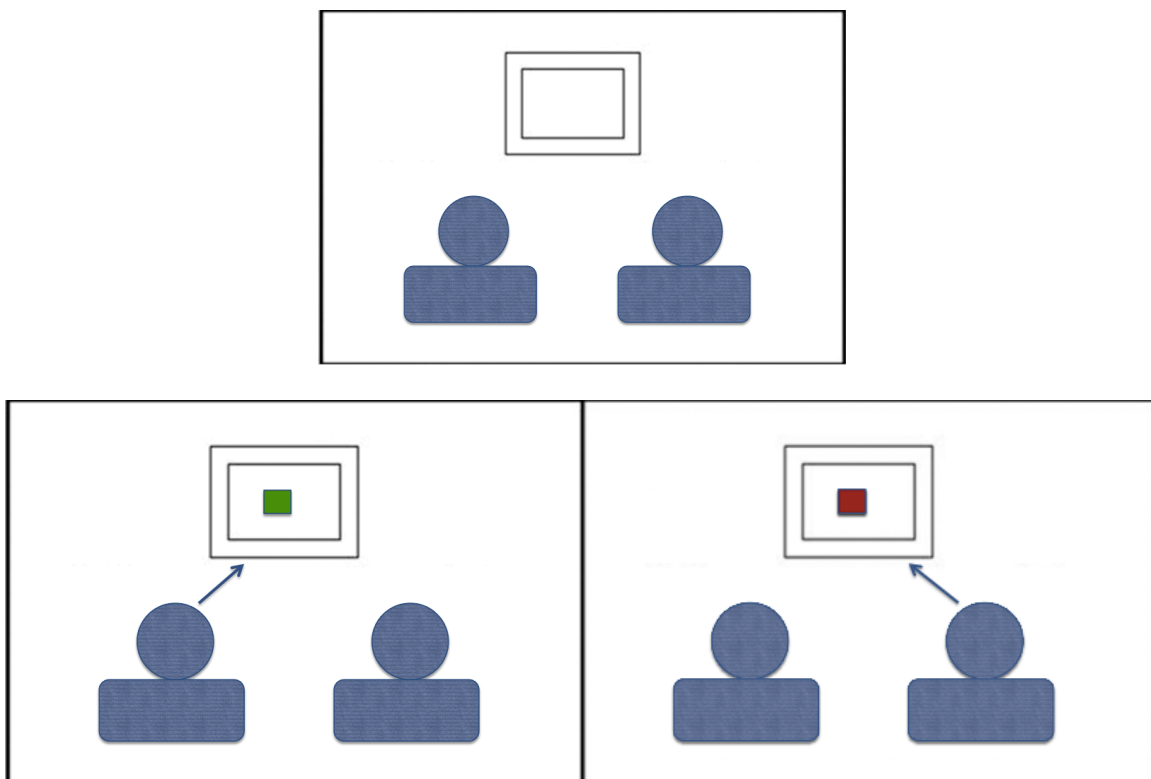
*Figure 2.* Individual Go-Nogo Task

In the Individual Go-Nogo task, the participant is instructed to only press a button in response to green squares and do nothing in response to red squares.



**Figure 3.** Joint Go-Nogo Task

In the Joint Go-Nogo task, the participant is given the same instructions as in the Individual Go-Nogo task: to press a button in response to green squares and do nothing in response to red squares). The confederate is given the opposite instructions: to press a button in response to red squares and do nothing in response to green squares.



## References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed., text rev.).
- Baskin-Sommers, A. R., & Newman, J. P. (2013). Differentiating the Cognition-Emotion Interactions that Characterize Psychopathy versus Externalizing. In *Handbook of Cognition and emotion* (pp. 501-520).
- Baskin-Sommers, A. R., Curtin, J. J., & Newman, J. P. (2011). Specifying the attentional selection that moderates the fearlessness of psychopathic offenders. *Psychological Science*.
- Baskin-Sommers, A., Krusemark, E., & Ronningstam, E. (2014). Empathy in narcissistic personality disorder: From clinical and empirical perspectives. *Personality Disorders: Theory, Research, and Treatment*, 5(3), 323.
- Burt, S. A., & Donnellan, M. B. (2009). Development and validation of the Subtypes of Antisocial Behavior Questionnaire. *Aggressive behavior*, 35(5), 376-398.
- Davis, M. H. (1983). Measuring individual differences in empathy: evidence for a multidimensional approach. *Journal of personality and social psychology*, 44(1), 113.
- Dolk, T., Hommel, B., Prinz, W., & Liepelt, R. (2013). The (not so) social Simon effect: a referential coding account. *Journal of Experimental Psychology: Human Perception and Performance*, 39(5), 1248.
- Fan, Y., Wonneberger, C., Enzi, B., de Greck, M., Ulrich, C., Tempelmann, C., . . . Northoff, G. (2011). The narcissistic self and its psychological and neural correlates: An exploratory fMRI study. *Psychological Medicine*, 41, 1641–1650.
- Gill, K. L., & Calkins, S. D. (2003). Do aggressive/destructive toddlers lack concern for others? Behavioral and physiological indicators of empathic responding in 2-year-old

- children. *Development and Psychopathology*, 15(01), 55-71.
- Guagnano, D., Rusconi, E., & Umiltà, C. A. (2010). Sharing a task or sharing space? On the effect of the confederate in action coding in a detection task. *Cognition*, 114(3), 348-355.
- Hall, J. R., Bernat, E. M., & Patrick, C. J. (2007). Externalizing psychopathology and the error-related negativity. *Psychological Science*, 18(4), 326-333.
- Hare, R. D. (2003). Hare PCL-R: Technical Manual. *Toronto: MHS*.
- Hare, R. D. (2006). Psychopathy: A clinical and forensic overview. *Psychiatric Clinics of North America*, 29(3), 709-724.
- Hare, R. D., & Neumann, C. S. (2010). Psychopathy: Assessment and forensic implications. *Responsibility and psychopathy: Interfacing law, psychiatry and philosophy*, 93-123.
- Hiatt, K.D., Schmitt, W.A., & Newman, J.P. (2004). Stroop tasks reveal abnormal selective attention among psychopathic offenders. *Neuropsychology*, 18, 50–59.
- Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, R. L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and individual differences*, 32(3), 401-414.
- Iacono, W. G., Malone, S. M., & McGue, M. (2008). Behavioral disinhibition and the development of early-onset addiction: common and specific influences. *Annu. Rev. Clin. Psychol.*, 4, 325-348.
- Muller, J. L., Sommer, M., Dohnel, K., Weber, T., Schmidt-Wilcke, T., & Hajak, G. (2008). Disturbed prefrontal and temporal brain function during emotion and cognition interaction in criminal psychopathy. *Behavioral sciences & the law*, 26(1), 131.
- Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. *Journal of abnormal psychology*, 95(3), 252.



- Newman, J. P., Curtin, J. J., Bertsch, J. D., & Baskin-Sommers, A. R. (2010). Attention moderates the fearlessness of psychopathic offenders. *Biological psychiatry*, *67*(1), 66-70.
- Newman, J.P., Schmitt, W.A., & Voss, W. (1997). The impact of motivationally neutral cues on psychopathic individuals: Assessing the generality of the response modulation hypothesis. *Journal of Abnormal Psychology*, *106*, 563-575.
- O'Hagan, M., Kindlon, D., Buka, S., Raudenbush, S., and Earls, F. (1998). Assessing exposure to violence in urban youth. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *39*(2), 215-224.
- Patrick, C. J., Curtin, J. J., & Tellegen, A. (2002). Development and validation of a brief form of the Multidimensional Personality Questionnaire. *Psychological assessment*, *14*(2), 150.
- Paulhus, D. L., Hemphill, J. F., & Hare, R. D. (2012). Self-report psychopathy scale (SRP-III). *Toronto: Multi-Health Systems*.
- Reniers, R. L., Corcoran, R., Drake, R., Shryane, N. M., & Völlm, B. A. (2011). The QCAE: A questionnaire of cognitive and affective empathy. *Journal of personality assessment*, *93*(1), 84-95.
- Ritter, K., Dziobek, I., Preissler, S., Rüter, A., Vater, A., Fydrich, T., . . . Roepke, S. (2011). Lack of empathy in patients with narcissistic personality disorder. *Psychiatry Research*, *187*, 241–247.
- Sebanz, N., Knoblich, G., & Prinz, W. (2003). Representing others' actions: just like one's own?. *Cognition*, *88*(3), B11-B21.
- Simon, J. R., & Rudell, A. P. (1967). Auditory SR compatibility: the effect of an irrelevant cue on information processing. *Journal of applied psychology*, *51*(3), 300.

- Tsai, C. C., Kuo, W. J., Hung, D. L., & Tzeng, O. J. (2008). Action co-representation is tuned to other humans. *Journal of Cognitive Neuroscience*, 20(11), 2015-2024.
- Vitale, J.E., Brinkley, C.A., Hiatt, K.D., & Newman, J. P. (2007). Abnormal selective attention in psychopathic female offenders. *Neuropsychology*, 21, 301-312.
- Vlainic, E., Liepelt, R., Colzato, L. S., Prinz, W., & Hommel, B. (2009). The virtual co-actor: the social Simon effect does not rely on online feedback from the other. *Embodied and grounded cognition*, 102.
- Welsh, T. N., Higgins, L., Ray, M., & Weeks, D. J. (2007). Seeing vs. believing: Is believing sufficient to activate the processes of response co-representation?. *Human Movement Science*, 26(6), 853-866.
- Wechsler, D., Laicardi, C., & Orsini, A. (1997). *WAIS-R: Wechsler adult intelligence scale revised: manuale*. OS.
- Wilkinson, G. S. (1993). *WRAT-3: Wide range achievement test administration manual*. Wide Range, Incorporated.
- Zachary, R.A. (1986). *Shipley Institute of Living Scale: Revised manual*. Los Angeles, CA: Western Psychological Service.