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The Effect of Ostracism and the Influence of Childhood Emotional Invalidation on Impulsivity: An EEG Study

Matthew N. Tyra
University of South Carolina - Aiken

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Matthew N. Tyra

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Abstract

Impulsivity is a multi-faceted construct that underlies many forms of maladaptive behavior. There are multiple influences that precede impulsive behavior, and one of these may include the feelings of childhood invalidation and negative peer interactions, specifically being ostracized. However, these relationships have not been heavily examined. This study therefore integrates a multidisciplinary approach in order to better understand impulsivity, parent and peer relationship influences, and the neural activity related to this behavior as measured by electroencephalogram (EEG). Using EEG, the lateralized readiness potential (LRP) component was measured as an index of brain activity related to selective motor activation. Impulsivity measurements included both behavioral and survey data. An experimental design was implemented to test the effects of ostracism on impulsivity and the LRP waveform, and a correlational design was used to examine the relationship with childhood emotional invalidation with these variables. Thirty-four undergraduate students from the University of South Carolina-Aiken participated in the study. Several notable findings were found in this study: (1) individuals that experienced ostracism had decreased performance on the Flanker Task and some patterns of the LRP waveform that are indicative of impulsivity, (2) perceived childhood emotional invalidation was related to facets of impulsivity, and (3) self-reported impulsivity trait scores were not related to Flanker Task performance or LRP waveform data. These findings highlight the impact of social interactions on impulsivity levels in its different forms. Further understanding of this relationship through future studies may provide interventions that could decrease the likelihood of maladaptive impulsivity levels. Lastly, the third finding of this study emphasizes the multifaceted nature of impulsivity and the need for future clarification of what aspects of impulsivity are measured by different modalities.

The Effect of Ostracism and the Influence of Childhood Emotional Invalidation on Impulsivity: An EEG Study

One of the most common questions that has been posed throughout history asks: why are there times when people act impulsively? It is a comfort to believe that each action is with a purpose and the best possible route to take towards an end goal. However, it is impossible to fully predict the possible consequences for each decision that has been made. With little exception, most people have acted impulsively. Although this is something most people experience, impulsivity is a complex and diverse concept that is still heavily being researched with many questions still not answered concerning the underlying mechanisms and prodromal contributions to the development of increased impulsive behavior. As such, this study seeks to examine the relationship between impulsive behaviors with emotional invalidation and select neurological processes.

According to Daruna and Barnes (1993), impulsivity encompasses actions that have flawed planning, consist of risks beyond what is normally acceptable, or inappropriate to the context in which they are implemented. These individuals find it difficult to resist immediate gratification rather than wait for greater long-term gains. According to Depue & Collins (1999), impulsivity "comprises a heterogeneous cluster of lower-order traits that includes terms such as impulsivity, sensation seeking, risk taking, novelty seeking, boldness, adventuresomeness, boredom susceptibility, unreliability, and unorderliness" (p. 495). This cluster of traits exhibits the complexity of this behavior; however, it is important that risk factors and underlying relationships be understood so that the prevention of negative consequences such as increased suicidality (e.g., Dvorak & Malone, 2014), peer bullying (e.g., Espelage, Bosworth, & Simon, 2001), deviancy (e.g., Low & Espelage, 2014), and risky sexual behavior (e.g., Charnigo et al., 2012) can be reduced or avoided completely.

Impulsivity remains one of the most common diagnostic criteria across much of the fifth version of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-V). In fact, there is a section of the DSM-V dedicated to impulse-control disorders (e.g., conduct disorder, pyromania, and kleptomania). In addition, there are number of disorders across other diagnostic categories with diverse presentations of criterion related to impulsivity: antisocial personality disorder (e.g., deceitfulness or manipulation), borderline personality disorder (e.g., self-harm), attention-deficit/hyperactivity disorder (e.g., inability to remain on task), mania (e.g., excessive involvement in dangerous activities), bulimia (e.g., binge eating), mild neurocognitive disorder (e.g., maintaining attention), substance use disorders, and paraphilia disorders (American Psychiatric Association, 2013).

Impulsive behavior is not just specific to clinical populations but is also common among non-clinical populations as well (Lansbergen, Schutter, & Kenemans, 2007). However, non-clinical populations appear to exude more self-control (or inhibitory control) (Tice, Baumeister, Shmueli, & Muraven, 2007). The concept of self-control contains emotion regulation, restraint, and behavioral control (Carlson & Wang, 2007; Maloney, Grawitch, & Barber, 2012). This process takes mental resources, and once depleted, it becomes much more difficult to exhibit self-control (Tice et al., 2007). The resource requirements for inhibition of behavior could explain, in part, the higher rates of self-control in non-clinical populations who may have more efficiency in resource expenditure.

Perspectives of Impulsivity

In the three-factor theory, Eysenck and Eysenck identified three different dimensions of personality: neuroticism, psychoticism, and extroversion (H. J. Eysenck & Eysenck, 1985). In its first form, the three-factor theory contained impulsivity under the head of extraversion. In 1975, they removed impulsivity from its place as a subcomponent of extraversion and subdivided it into four dimensions: narrow impulsiveness, risk-taking, non-planning, and liveliness. They found narrow impulsiveness to be correlated with psychoticism but not with extraversion. The other factors described were, however, correlated with extroversion (Eysenck & Eysenck, 1985). Because of this, Eysenck and Eysenck (1985) included impulsivity as venturesomeness under extraversion and impulsiveness under psychoticism. Venturesomeness describes the tendency to be sensation-seeking. This is counter to the previous understanding that impulsivity was the inability to inhibit risk-taking tendencies (Eysenck & Eysenck, 1985).

In line with research concerning psychoticism described by Eysenck and Eysenck (1985), much research has been conducted exploring antisocial behaviors and impulsivity. For example, in a study examining a rather large population of participants detained in a detention center, impulsiveness was found to be a key feature for the criminal population examined (S. B. Eysenck & McGurk, 1980). Further, it was found that subjects diagnosed with antisocial personality disorder (ASPD) exhibited increased motor impulsiveness (i.e., acting without thinking) when compared to nonclinical samples (Fossati et al., 2004) Similarly, in an examination of the impulsive differences in borderline personality disorder (BPD) and ASPD, ASPD was found to have higher rates of sensation-seeking behavior and lower rates of response premeditation (DeShong & Kurtz, 2013).

A common aspect of sensation-seeking is the inability to delay gratification or having an increased reinforcing effect from certain stimuli. For example, comorbid diagnosis of substance use disorder and ASPD has been found to increase reward-delay impulsivity (i.e., individuals who were comorbid tended to prefer immediate smaller gratification rather than delayed larger gratification) (Petry, 2002). In addition, highly impulsive individuals show increased reward sensitivity in both substance use disorders and eating disorders (e.g., bulimia) (Dawe & Loxton, 2004). This further supports the inclusion of sensation-seeking into the conceptualization of impulsivity, and have further been supported in studies examining increased sexual risk-taking (Donohew et al., 2000), and gambling (Nower, Derevensky, & Gupta, 2004).

Whiteside & Lynam (2001) integrated previous conceptualizations of impulsivity into a more comprehensive understanding. From this integration, they developed the five-factor model of impulsivity including: premeditation, perseverance, sensation seeking and urgency (subdivided in to negative and positive urgency). These five facets were described not as variations of impulsivity, but rather psychological processes that initiate ‘impulsive-like’ behaviors (Whiteside & Lynam, 2001).

The first factor, premeditation, is possibly the most commonly associated process, and it refers to the tendency to think about outcomes of actions prior to engaging in that action. In other words, those that are low in premeditation show little forethought prior to acting (Whiteside & Lynam, 2001). This was supported by Zermatten et al., 2005, who found that individuals who exhibited lower scores on the premeditation subtest took more time to learn to choose the advantageous card deck in a gambling task (Zermatten, Van der Linden, d’Acremont, Jermann, & Bechara, 2005).

The second facet, perseverance, is also among the most frequently studied in conceptualizations of impulsivity. This facet refers to the ability to maintain attention to a task regardless of boredom levels (Whiteside & Lynam, 2001). Perseverance appears to account for much of the symptomology of borderline personality disorder and is present in risky sexual behaviors (Miller et al., 2003). Furthermore, a study examining procrastination showed a direct relationship between perseverance and procrastination suggesting an impaired ability to maintain attention towards tasks that are not pleasurable, and instead, showed a vulnerability for pleasurable distraction (Dewitte & Schouwenburg, 2002).

The third facet, sensation seeking, refers to a tendency to seek activities that are exciting and having an openness to experiences that may or may not be dangerous (Whiteside & Lynam, 2001). This facet has been found to positively correlate with gambling (e.g., Nower, Derevensky, & Gupta, 2004), risky sexual behaviors (Donohew et al., 2000), binge eating (Dawe & Loxton, 2004), and antisocial behaviors (e.g., Gatzke-Kopp, Raine, Loeber, Stouthamer-Lober, & Steinhauer, 2002). Beyond clinical populations, higher levels of sensation-seeking are seen in adolescence and contribute heavily to risk taking behaviors and the higher rates of suicidality in this age range (Ortin, Lake, Kleinman, & Gould, 2012).

The last facet, urgency, is the tendency to experience strong impulses under certain affective states. Among the four major facets, this type of impulsivity is the least researched. Originally, urgency referred only to negative mood states (e.g., anger or anxiousness) (Whiteside & Lynam, 2001). More recently, however, urgency has been expanded to include positive mood states (such as happiness) (Cyders et al., 2007). Urgency has also been associated with borderline personality disorder (BPD), such that patients with BPD generally exhibit impulsive-like behaviors due to ineffective coping of negative affective states (Linehan, 1993). Furthermore, elevated or depressed mood has been shown to increase the likelihood and amount of drinking and risk-taking proclivities (Nolen-Hoeksema & Harrell, 2002).

Anatomy of Impulsivity

Our understanding of the neurological components of impulsivity have largely been attributed to the advances in our understanding of the prefrontal cortex (PFC). In a review, Miller & Cohen (2001) provide a rather comprehensive exploration of the role the prefrontal cortex has on cognitive control. Within the PFC, the medial prefrontal cortex (mPFC) is integral in the integration of sensory information, thoughts, and actions to achieve goals (Miller & Cohen, 2001). In other words, the mPFC acts as an attention mechanism that focuses on important information needed in decision-making processes.

Another important area of the prefrontal cortex is the orbitofrontal cortex (OFC), located in the ventral portion of the frontal lobe. Evidence suggests that the OFC is involved in many human functions such as control of mood and adjustment, drive and responsibility, reward and punishment anticipation, and partial origin and maintenance of personality traits (Cavada, Compañy, Tejedor, Cruz-Rizzolo, & Reinoso-Suárez, 2000). In other words, this area of the prefrontal cortex is integral in the cognitive processing of decision making. Impulsive gamblers have shown decreased activation in the reward processing areas of the brain, including the ventromedial prefrontal cortex (vPFC) (Reuter et al., 2005). This suggests that there is a reduced response to reward that would normally inhibit future behaviors to achieve the same sense of reward achievement that is more easily achievable non-gamblers. Lesions in the prefrontal region have been shown to decrease inhibition (Friedman & Miyake, 2004), information misappraisal (Blair, 2003), and increased delayed-discounting impulsivity (Zeeb, Floresco, & Winstanley, 2010).

Other regions of the brain also play a role in impulsive decision-making, including the limbic system and anterior cingulate cortex. The medial temporal limbic structures are important for long-term memory and processing of states such as mood and motivation (Miller & Cohen, 2001). For instance, the amygdala is responsible for emotion and pleasure-aversive appraisal, and damage to this structure has been shown to reduce emotional recognition and aversive learning (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006). The limbic system also has connections with the mPFC and OFC (reference). Finally, in an examination of individuals with borderline personality disorder (BPD) the anterior cingulate cortex (ACC) had reduced activation further inhibiting error processing and emotional self-monitoring (de Bruijn et al., 2006).

In summary, the prefrontal cortex is highly important for multiple facets of impulsivity, especially as it relates to executive functioning such as problem-solving and response inhibition. Furthermore, the subcortical and temporal region of the brain has strong contributions to impulsive processes in the form of emotion management, memory, error processing, and learning.

Emotional Invalidation and Ostracism

Emotional invalidation is defined as a response that minimizes, punishes, or ignores the inner emotional experiences of an individual, which in some forms can be classified as emotional abuse (Linehan, 1993). Emotional invalidation has been linked to borderline personality disorder, alexithymia, eating disorders, anxiety, and depression (Grynberg, Luminet, Corneille, Grèzes, & Berthoz, 2010; Mountford, Corstorphine, Tomlinson, & Waller, 2007; Selby, Braithwaite, Joiner, & Fincham, 2008; Sturrock & Mellor, 2014). While these studies have examined the effects of childhood emotional invalidation from parental figures, there have been other studies examining the effects of other rejecting behaviors.

Ostracism is a form of social exclusion in which the individual's perception of belongingness or relational connection is belittled (Zadro, Williams, & Richardson, 2004). This minimization of belongingness should be seen as an invalidation of connection between the individual and the desired group. According to Renneberg et al. (2011), individuals with borderline personality disorder, who are particularly sensitive to invalidation, show increased negativity such as anger or sadness in comparison to healthy controls. In another study, Cyberball was used to examine the emotional damage comparing the effect of perceived real players versus knowing the other players are artificial. The findings suggest that the emotional detriment was strong enough that even in the non-deceived group negativity and reduced feelings of belongingness are significant (Zadro, Williams, & Richardson, 2004). Interestingly, social exclusion has been linked to a reduction in performance on cognitive tasks that require effortful processing and reasoning (Baumeister, Twenge, & Nuss, 2002), and has been linked to aggression and lower self-esteem in adulthood (Warburton, Williams, & Cairns, 2006; Zadro et al., 2004).

Emotional invalidation is described as a core moderator of emotional abuse. In other words, the degree of emotional invalidation is a strong determining factor of the total detriment of the emotional abuse (Waller, Corstorphine, & Mountford, 2007). Linehan (1993) states than an invalidating environment is one that discourages negative emotions while encouraging wanted emotions, and describes three types of emotionally invalidating environments. In the first type of emotionally invalidating environment described (i.e., typical environment), the control of emotions is encouraged while an emphasis is placed on achievement. The second is called a perfect environment, where the parental figures become angered when the child shows emotions such as fear or anger. The child, after a time, learns to suppress such emotions to avoid these reactions from his/her parents. The third environment is a chaotic environment, where the parent is completely unavailable to the child for emotional support due to a variety of reasons (e.g., work, health, or substance use). It is important to note that in the previously described environments that the first two types are more invalidating through minimization or punishment, and in the third environment, the type of emotional invalidation is better labeled as neglect (Linehan, 1993).

When examining eating disorders, emotional abuse, defined as ridiculing, threatening, blaming, or insulting, was found to be a far greater predictor of eating disturbance than sexual or physical abuse (Kent, Waller, & Dagnan, 1999).The same study found that the effects of physical and sexual abuse on the development of the psychopathology appear to be through their relation to emotional abuse. The effect of the emotional abuse was mediated by the development of anxiety and dissociation following the emotional abuse (Kent et al., 1999).

While the psychopathological outcomes are important, other outcomes such as emotional inhibition, alexithymia, and distress tolerance provide important connections to impulsivity. Emotional inhibition is the prevention of spontaneous action, communication, or feelings. This is generally a conscious effect to inhibit reactions that the individual believes will elicit disapproval, personal shame, or loss of control (Young, Klosko, & Weishaar, 2003). Alternatively, alexithymia is another potential outcome, and while emotional inhibition is generally a conscious effort, alexithymia is an inability to express feelings due to an unawareness of these feelings.

An invalidating environment can lead to the inability to respond effectively to one’s own emotions, and because of this, can lead to disrupted emotion regulation (Waller et al., 2007). Specifically, the individual is more likely to look towards environmental cues to determine effective responses. As a result, due to externally regulating their emotions, the individual has not learned adaptive emotion regulation, which reduces the individual’s ability to properly manage strong emotions (i.e., distress intolerance) (Waller, Corstorphine, & Mountford, 2007).

Emotion regulation is a set of extrinsic and intrinsic processes for examining, appraising, and altering emotional responses to achieve objectives (Thompson, 1994). Furthermore, emotion regulation also includes the degree at which an individual can endure certain emotionally charged situations. Furthermore, the process of moderating responses can take the form of behavioral expression (e.g., lashing out in anger) or physiological expression (e.g., increased heart rate) (Gross, 1998). In short, when in the presence of an emotionally invalidating environment, an individual has a propensity to become more externally regulating of their emotions. They begin to look outwards for how to express, or even feel, their emotions. The internal regulation mechanisms that are needed for adaptive functioning are not fostered in these environments because one begins to have distrust in one's own emotions and emotional expression.

Emotion regulation has been studied as one of the underlying factors of a number of psychopathological disorders such as borderline personality disorder (BPD) (Donegan et al., 2003). Borderline personality disorder is characterized by a marked instability in relationships, emotions, and self-image. Risky and self-mutilating behaviors have been implicated as being avoidance or modification mechanisms of emotional experiences due to emotion regulation (Chapman, Gratz, & Brown, 2006). Interestingly, research shows a strong association with BPD (and emotion regulation) and childhood abuse (Herman, Perry, & van der Kolk, 1989). Further, parents with higher levels of emotion dysregulation tend to invalidate their children more often and, in turn, result in difficulty with emotion regulation in their children (Strepp, Whalen, Pilkonis, Hipwell, & Levine, 2011). This consistent presence of an emotionally invalidating environment does not support the learning of adaptive skills and strategies to cope with emotionally polarized situations. Not learning effective coping strategies may be a potential reason for internalizing and externalizing symptoms. For example, lack of externalizing symptom (i.e., behavioral expression) regulation skills can be due to maladaptive emotion regulation skills (e.g., negative or positive impulsive urgency) (Buckholdt, Parra, & Jobe-Shields, 2014).

Impulsivity and Emotion Regulation

As should be readily evident, much of the aforementioned concepts regarding emotion regulation and impulsivity are very much related. For example, some of the brain regions controlling behavioral inhibition are also present in the process of emotion regulation (Thompson & Goodman, 2009). Specifically, the prefrontal cortex (PFC) is integral in both processes by integrating sensory information to form a decision towards a goal. Further, the development of emotion regulation (or dysregulation) relies heavily on the ability to discriminately attend to stimuli while having the ability to block interference (Gross, 1998).

Attention-deficit hyperactivity (ADHD) disorder also provides evidence on the relationship between emotion regulation and impulsivity. Previous research has found that children with ADHD have difficulties with emotion regulation and masking these emotions even when researchers prompt the children (Walcott & Landau, 2004). Even within this disorder, there are multiple levels of disinhibition and emotion dysregulation issues. There are three possible diagnostic categories of ADHD: primarily inattentive (ADHD-I), primarily hyperactive (ADHD-H), or combined (ADHD-C). Maedgen and Carlson (2000) found that children with ADHD-C exhibited more aggressive behaviors, and these children had higher ratings of emotion dysregulation with higher intensity and frequency of positive and negative behaviors. These children also exhibited no difference in social awareness and attempts to regulate their emotions. Children with ADHD-I, however, did not exhibit issues with emotion regulation but did show deficits in social aptitude and assertiveness (Maedgen & Carlson, 2000). The increase in emotion dysregulation in the combined type and increased behavioral expression exhibits the link between impulsivity and emotion regulation.

As previously mentioned, the relationship between affective states and impulsive behavior is expressed using the factor urgency (e.g., Cyders et al., 2007; Whiteside & Lynam, 2001) and has led to research concerning this relationship's role in eating disorders (e.g., Anestis, Smith, Fink, & Joiner, 2009), self-harm, and alcohol consumption (Dir, Karyadi, & Cyders, 2013). Further, this construct was able to identify risk of future gambling addiction and explain some problem drinking behavior (Cyders et al., 2007).

In sum, the relationship between emotion regulation and impulsivity rests in the underlying mechanisms that prevent the expression of internal states as a result of a stimuli. More specifically, inhibiting behaviors as a result of emotion dysregulation and impulsivity is rather difficult because of either misappraising the importance of a stimuli (such as an emotional state), not properly attending to a stimulus, having maladaptive coping mechanisms (such as self-injurious behaviors), and inefficiently using cognitive resources to regulate expression and attention.

Behavioral Tests of Impulsivity

Two commonly used paradigms have been utilized to examine impulsivity. These include the Go/No-Go (GNG) task and the Erikson Flanker Task. The GNG task in its most basic definition involves the competition between responding to a specific stimulus (i.e., the "Go" stimuli) or inhibiting a specific behavioral response to a stimulus (i.e., the "No-Go" stimuli) (Nieuwenhuis, Yeung, van den Wildenberg, & Ridderinkhof, 2003). As stated, the GNG task contains two different types of stimuli: a common "Go" stimulus and a less common "No-Go" stimulus. Inhibiting response towards the stop signal (i.e., “No-Go” stimuli) requires an individual to overcome established prepotent responses. (i.e., habitual behaviors that have been previously rewarded and have become superiorly placed above other possible responses) (Donkers & Van Boxtel, 2004; Friedman & Miyake, 2004). Within this task, increasing the frequency of go signals will increase the strength of the prepotent response. Furthermore, the ability to inhibit these responses are measured by examining response time (RT) and frequency of errors (Johnstone et al., 2007) during the no-go trials.

While the GNG task is an appropriate measure of resistance towards established behavioral patterns, the second behavioral task, The Erikson Flanker Task, is a selective attention task in which the participant must accurately respond in the presence of distracting stimuli (Eriksen & Schultz, 1979). The essential basis of the paradigm is a row of stimuli that is presented to the participant, and of these stimuli, the central stimulus is presented as the target stimulus and the remaining stimuli (i.e., flanker stimuli) serve as distractors. In the original designs, the stimuli were letters, but more recently arrows are used (Erikson & Schultz, 1979). There are two types of trials: congruent and incongruent trials. In the congruent trial, the central stimulus matches the remaining stimuli (e.g., <<<<<); however, in an incongruent trial, the central stimulus does not match the remaining stimuli (e.g., <<><<). Data obtained using this paradigm generally contains reaction time and accuracy for each type of trial.

A wide breadth of research has been conducted using the flanker task concerning impulsivity. As previously mentioned, the Flanker task concerns selective attention, and research suggests that expectations and attention are the main moderators of behavioral expression of impulsivity in comparison to inhibitory control or response bias (Kenemans et al., 2005). Children with attention-deficit/hyperactivity disorder (ADHD), for example, have showed significant reduction in reaction time and accuracy in the incongruent trials when compared to the congruent trials. This suggests a particular sensitivity to task interference and increased cognitive demand (Mullane, Corkum, Klein, & McLaughlin, 2009). Similarly, participants with stimulant and alcohol use disorders have also shown poorer performance (i.e., lower reaction time and accuracy) on the speeded flanker task than controls. Unlike the participants with ADHD though, the participants with stimulant use disorder, more specifically cocaine, exhibit more omission errors in the congruent trial condition (rather than incorrect responses in the incongruent trial condition) (Schellekens et al., 2010; Sokhadze, Stewart, Hollifield, & Tasman, 2008).

Electroencephalogram (EEG)

Recently, there have been monumental advances in the field of neuroscience that have allowed researchers to further understand constructs by examining the brain in both function and structure. Indeed, the field of impulsivity has not been excluded from this directional shift. As mentioned a number of times above, using such research, there have been correlational findings of impulsive processes to certain brain components. Electroencephalogram (EEG), a non-invasive neuroimaging technique, is among one of the widely used techniques that have provided these described findings. This is also the technique that was used in the current study.

The EEG measures electrical activity produced by the brain using electrodes that are placed on the head of the participant. The placement of the electrodes is dependent on the purpose of the data collection, and is generally based on the International 10/20 system in which the electrodes are 10% and 20% from four distinct anatomical features: bridge of the nose (nasion), the protuberance on the back of the head (inion), and the indentions anterior to each ear (preauricular points) (Ray & Slobounov, 2006). Electrical activity produced by active nerve cells are spread across the scalp and can be read by the EEG by recording the difference between two electrodes. The reference electrode is an electrode that is subject to the same voltage changes that affect measurement electrodes (e.g., sweating) (Michel & Murray, 2012). The reference is chosen to be the baseline level of electrical activity and is generally placed on the head in areas such as the earlobes, mastoid bone, or nose (Ray & Slobounov, 2006).

In terms of the potential neural activity data that can be examined, this study measured the lateralized readiness potential (LRP), which is a type of event-related potential (ERP). An event-related potential is an elicited electrical waveform that is produced from neuronal activity as a result of a specific stimuli (Luck, Woodman, & Vogel, 2000). For example, the lateralized readiness potential (LRP) waveform is produced from preparation of voluntary muscle movement (such as hand movement) (Kóbor, Takács, Honbolygó, & Csépe, 2014). As such, tasks that require the participant to press a button will create the LRP waveform from the voluntary hand movement. Because the ERP is a smaller component of the overall EEG data, the waveform is time-locked to a time period around a stimulus (such as a flanker) and averaged across multiple epochs (time frames). Each ERP varies in its latency and amplitude based upon conditions and specific stimuli unique to each component. As such, experimental manipulation is possible.

The Lateralized Readiness Potential (LRP) is a primarily movement-based brain potential (Hackley & Valle-Inclán, 2003). To measure this component, the difference of the ipsilateral (same side) and the contralateral (opposite side) of brain relative to the responding hand is calculated for each response (e.g., pressing the right button for a congruent flanker trial) (Kóbor et al., 2014). So, for example, using the Flanker Task, if the right button is pressed using his or her right hand for a congruent trial, the difference of the right side of the brain and the left side would be calculated (i.e., right activation - left activation). A negative trending waveform contralateral to the responding hand indicates preparation processes (Kappenman et al., 2012). In other words, the onset of the LRP wave indicates that the participant has begun the decision making process regarding the specific stimulus response. If inhibition is taking place, there will be a slowing in the rise of this LRP peak (Donkers & Van Boxtel, 2004).

Kobor et al. (2014) found that the participants with higher levels of impulsivity exhibited a delayed negative trend that suggests weaker inhibition that is consistent with lower response inhibition that characterizes impulsivity. Similarly, participants under the influence of low levels of alcohol exhibited similar findings to that from the impulsivity research (Marinkovic, Halgren, Klopp, & Maltzman, 2000). This is consistent with previous findings that individuals with substance use disorders generally have higher levels of impulsivity. Interestingly, another study examining the LRP differences between introverted and extroverted individuals showed that extroverted individuals have a shorter response-locked LRP (i.e., the time period around the response) and a longer stimulus-locked LRP (i.e., the time period around the stimulus) than introverted individuals. This suggests that extroverted individuals engage in responses faster and less efficiently than introverted individuals (Houlihan & Stelmack, 2011). Taken together, the LRP waveform might possibly be useful as a psychological index of impulsivity.

Current Study

As described above, it is important to examine the underlying mechanisms of impulsivity as it is present in many forms of psychopathology (e.g., borderline personality disorder, addictions, eating disorders, antisocial personality disorder, and attention-deficit/hyperactivity disorder). However, many previous studies have used survey measures, behavioral tasks, and physiological measures, but rarely have they been integrated when examining impulsivity. Thus, this study seeks to determine the relationship of impulsivity and emotional invalidation. More specifically, this study examined the role of childhood emotional invalidation and current ostracism on levels of impulsivity.

Hypotheses

Based on previous research, the following hypotheses were made:

1. Hypothesis 1: Manipulation of ostracism by the Cyberball task will cause a significant difference in impulsivity (as measured by the Flanker task). Specifically, participants in the experimental (ostracized) condition will display higher levels of impulsivity (i.e., participants will have lower accuracy) compared to the control group after accounting for perceived childhood emotional invalidation.
2. Hypothesis 2: The experimental (ostracized) group will have an increased amplitude of the positive going LRP, and a delayed latency of the negative-going LRP for incongruent Flanker trials after accounting for childhood emotional invalidation.
3. Hypothesis 3: It is predicted that scores on the UPPS will be correlated with LRP waveform data. More specifically, there will be an increased amplitude of the positive-going LRP, and a delayed latency of the negative-going LRP for incongruent Flanker trials. This would suggest a deficit in interference suppression and response inhibition, respectively, which is characteristic of impulsivity.
4. Hypothesis 4: Scores on the UPPS will negatively correlate with accuracy on the Flanker task, as seen in previous findings (e.g., Mullane et al., 2009). In other

words, it is expected that participants with higher self-report levels of impulsivity will perform worse on the behavioral task due to lowered behavioral inhibition.

Method

Participants

This study utilized students from the University of South Carolina-Aiken who are currently enrolled in an undergraduate introductory psychology course, ranging in age from 18 to 25 (M= 19.6, SD=1.75). The final sample demographic table is detailed in Table 1. Participants were awarded course credited that was applicable to their experimental participation requirement. All participants were provided with written informed consent at the beginning of testing outlining the study's procedures as well as the risks and benefits of participating. This study was approved by the Institutional Review Board at the University of South Carolina.

Exclusionary factors for the current study were listed on SONA (the participant scheduling system) and were again filtered at time of arrival. Such exclusionary factors included: previous or current psychiatric diagnosis, major previous head trauma, and current use of select psychoactive medications (specifically, medications affecting brain activity such as sedatives, stimulants, or anticonvulsants). Individuals who did not meet these criteria were excluded from further participation in this study. The current study had a recruited 64 participants, however 14 participants were excluded from participating for these above factors. From those not allowed to continue in the study, two were excluded because of medication or substance use, one because of previous head trauma, one because of a current psychiatric diagnosis, and four because of handedness. Furthermore, the electroencephalogram requires the usage of a cap to place measurement electrodes, and because of this, hair that prevents the cap placement or access to the scalp were excluded (N = 6). Additionally, 14 participants who did participate in the study were eliminated from the final sample due to bad data from the EEG (specifically, noise artifact caused by excessive movement, eye blinks, or perspiration) and two were dropped because of extreme inaccuracy on the behavioral task. This resulted in 34 participants in the final analyses.

Measures

The first goal of this study was to determine whether perceived childhood emotional invalidation and ostracism were related to levels of impulsivity. More specifically, this study examined how childhood emotional invalidation and experimentally-manipulated ostracism were related to levels of impulsivity. Childhood emotional invalidation was measured using a self-report survey (Invalidating Childhood Environment Scale). Impulsivity was measured using both a self-report measure and behavioral task performance from the Flanker task (described below). The second goal of this study was to examine whether manipulation of induced ostracism, specifically by incorporating a computer game, has an effect on brain activity as measured by electroencephalography (EEG). Brain activity data was recorded during the Flanker task. These measures are described in detail below.

Demographics Questionnaire (See Appendix A). Each participant was asked to complete a demographics questionnaire aimed at collecting qualitative information. This information was used in two ways. Some demographic questions (specifically gender and age) were used as qualitative descriptors and aid in the process of equalizing the groups described below. The remaining questions (i.e., handedness, caffeine use on the day of the study, previous night's sleep, and time since last meal) were used to account for potential confounds in electroencephalogram (EEG) data.

UPPS (Cyders, et al., 2007; see Appendix B). The UPPS is a 59-item multidimensional self-report measure that addresses different facets of impulsivity using five dimensions (Cyders et al., 2007; Whiteside, Lynam, Miller, & Reynolds, 2005; Whiteside & Lynam, 2001). These five dimensions of impulsivity are: Negative Urgency (e.g., “Sometimes I do impulsive things that I regret later”, Premeditation (e.g., “I usually think carefully before I do anything”), Perseverance (e.g., “I am a person who always gets the job done”), Sensation Seeking (e.g., “I would like to go scuba diving”), and Positive Urgency (e.g., “I am surprised at things I do while in a great mood”). The first dimension, Negative Urgency, assesses an individual’s tendency to give in to impulses when accompanied by negative emotions such as anxiety or anger. The second dimension, Premeditation, assesses an individual’s ability to plan before taking action. The next dimension, Perseverance, assesses an individual’s ability to complete a task regardless of levels of boredom or fatigue. The fourth dimension, Sensation seeking, assesses an individual’s drive to find stimulation or excitement. The final dimension, Positive Urgency, assesses an individual’s tendency to give in to impulses when accompanied by positive emotions such as happiness. The item responses are on a 4-point Likert scale ranging from 1 (“*agree strongly”*) to 4 (*“disagree strongly”*). The scales have 12, 11, 10, 12, and 14 items respectively. The UPPS is calculated by summing the items within each subscale with higher scores indicating higher levels of impulsivity in that domain. Internal validity was measured for the five dimensions using Chronbach’s α and values ranged from .82 to .91 (Whiteside & Lynam, 2005).

Invalidating Childhood Environment Scale (ICES; Mountford et al., 2007; see Appendix C). The ICES is an 18-item self-report measure of perceived emotional invalidation of childhood environments prior to the age of eighteen. This measure is divided into two subsections with the first 14-items being rated twice (once for each parent) concerning the perceived relationship between the participant and each parent. These items are rated on a 5-point Likert scale ranging from 1 (“*Never*”) to 5 (“*All of the time*”). In the current study, a composite score was calculated by computing the total sum of both the paternal and maternal scores on the first 14-items to achieve a “total invalidating environment” score. These items have showed good levels of internal consistency among clinical populations (paternal invalidation α = 0.796; maternal invalidation α = 0.772) and moderate internal consistency among non-clinical populations (paternal invalidation α = 0.587; maternal invalidation α = 0.664; Mountford et al., 2007).

Flanker Task (Eriksen & Schultz, 1979; Kappenman et al., 2012)**.** The visual flanker task is a psychometric measure of selective attention (i.e., interference control) in which the participant is asked to press a left- or right-hand button to indicate whether a central target stimulus is pointed either left (i.e., <) or right (i.e., >) and this stimuli is accompanied on both sides by flanking stimuli that was either congruent (i.e., <<<<< or >>>>>) or incongruent (i.e., <<><< or >><>>).

All stimuli were presented in white on a black background on a 40.5 x 32cm LCD Dell monitor. The monitor was viewed at a distance of 100 cm. The central target stimulus was a left or right angle bracket (i.e., < or >), measuring 1 degree of visual angle and was presented in the middle of the monitor. The flanker stimuli consist of four symbols (two on each side of the target stimuli) that are either left or right angle brackets depending on the condition (congruent or incongruent). The flankers and targets were aligned horizontally and spaced .29 degrees of visual angle apart (center to center). The participant was asked to make a button-press as quickly as possible to indicate the direction of the target stimulus with the index finger of the right hand on a computer keyboard. To maximize effect, the flanker stimulus was presented 150 ms prior to target onset. The target stimulus was presented for 200 ms, and during this time the flanker stimuli was also visible. There was an inter-trial interval jittered between 1200-1400 ms (sampled randomly) immediately following the participant's response. This was done to decrease predictability of upcoming trial onsets and to decrease neural habituation (Kóbor et al., 2014). A minimum error rate of 10% was set for each block, and if this is met, the participant was asked to speed up on the subsequent blocks. Likewise, a maximum error rate of 20% was set for each block, and if this is met, the participant was asked to slow down on subsequent blocks.

Subjects completed 10 blocks of testing in which congruent or incongruent trials were presented in random order with equal frequency. Each block contained 40 trials (see figure 1), resulting in 400 total trials per experimental session. After each block, participants were given a self-paced rest period. Participants completed a practice block of 12 trials before the beginning of testing. During practice trials, an examiner was present to check for comprehension of the task directions.

Electrophysiological recording Electroencephalogram (EEG) activity was recorded using a 32-channel recording system (Brain Vision) system using electrodes mounted in an elastic cap utilizing a subset of the International 10/20 system sites (i.e., F3, Fz, F4, C3, Cz, C4, P3, Pz, P4, F7, F8, Fp1, Fp2, FC3, FCz, FC4, FT7, FT8, O1, Oz, O2, CP3, CPz, CP4, P7, P8, T7, T8, TP7, TP8, and left earlobe). Furthermore, data analysis of EEG data was done using Brain Vision Analyzer. The signals were recorded using a right earlobe reference electrode, and these were re-referenced offline to average bilateral earlobe sites (Kappenman et al., 2011). The horizontal and vertical electrooculogram (EOG), which is a tool to measure eye movement artifact, was recorded as the voltage between electrodes placed lateral to the external canthi and beneath the left eye, respectively. These electrodes are used to account for eye blinks and eye movement. Impedance, which is the opposition of electrical current due to living tissue that results in increased noise (i.e., distorted data; Kappenman & Luck 2011), was kept below 15KΩ.

The EEG and EOG was amplified by a Neuroscan Synamps amplifier with a gain of 500 and a bandpass of 0.1-100 Hz, and the amplified signals was digitized at 500 Hz and averaged offline. Stimulus-locked (i.e., epoch selection relative to the onset of the stimulus) was computed separately using a baseline of -200 to 0 ms for stimulus-locked averages (van Meel, Heslenfeld, Oosterlaan, & Sergeant, 2007). A low-pass filter was applied to account for high-frequency noise, potentially caused by electromyographic (i.e., muscle movement) noise (half-amplitude cutoff = 23.2 Hz, full width at half maximum = 18.8 ms). Trials with artifacts (such as from excessive head movement) or incorrect behavioral responses were excluded prior to analysis. Incorrect behavioral responses were excluded because only in correctly answered trials can the incorrect versus correct motor activation be seen (Verleger et al., 2009). In other words, motor preparation will begin with a positive trending signal of the prepotent activation of a response but will negatively trend as a competing response is activated (i.e., noticing the prepared response is incorrect). Furthermore, faster reactions lower than 200ms or trials with no response were eliminated from analysis to prevent missed or not properly attended trials from biasing data (Kóbor et al., 2014; Kappenman & Luck, 2011). Participants who had lower than a 60% accuracy rate or had artifacts in more than 40% of their data were excluded from the final analysis ($N = 16$).

The Lateralized Readiness Potential (LRP) is a more focused waveform, and therefore, calculations were narrowed to the C3 and C4 sites, which are located over the motor cortex in the right and left hemispheres (Kappenman et al., 2012). However, all 32 electrodes were utilized because the resolution of EEG waveform data is reduced with fewer electrodes (Light et al., 2010). Further, to isolate the LRP, a separate waveform was created based on lateralized hemisphere activity based on responding with the right hand only. To do this, an equation outlined by Cole (1989) was modified and used by calculating the right-hand response average differences of the C3 and C4 sites (i.e., mean$[(C'_3\text{-}C'_4)_{\text{right-hand movement}}]$) where negative deviation suggests preference for the correct response and positive deviation suggests preference for the incorrect response (Cole, 1989, p. 256). The LRP amplitude was measured as the mean amplitude in a measurement window (stimulus-locked = 200-500 ms) relative to the baseline voltage. The onset latency of the LRP was measured as the time point at which the voltage reached 50% of the peak amplitude.

Procedure

In this study, participants were recruited through the introductory psychology class at the University of South Carolina Aiken. The participants prior to enrollment were given eligibility criteria listed on the SONA website, and when they arrive they were again given the exclusionary criteria. Exclusion criteria pertained to that which would compromise EEG data (as listed above). If the participant was determined to be ineligible, they were not allowed to further participate in the study, and the screening form was shredded based on experimental ethical guidelines. Participants determined to be eligible were asked to read and sign an informed consent. All participants were given a copy of the informed consent document for their own records.

All participants were then asked to complete a paper-pencil formal demographics questionnaire. Following this, each participant was then prepared for EEG data collection. The participant's head was measured in order to properly fit the EEG cap to their head size. The cap was placed such that the Cz (see Figure 2) electrode is midway between the participant's ears and halfway between their nasion (frontal bone indent between the eyes) and inion (posterior bone protrusion at the back of the head). The electroconductive gel was injected into each electrode site and then checked for proper impedance levels throughout, which should be below 15KΩ.

Participants were then assigned to either the invalidation condition or control condition based on their gender. More specifically, the condition assignments were counterbalanced for each participant where males and female rotations were not combined. The participant was asked to play a computer game, called Cyberball. Cyberball is a ball-tossing game played with three people. However, only the participant is real and the other two players are computer confederates. These computer confederates are preprogrammed by the researcher to exclude the real participant a set percentage of total ball throws. Excluding the real participant from the game of toss is conducted in order to simulate ostracism, which in this case is the manipulated experimental condition (Williams & Jarvis, 2006). This ostracized condition should stimulate rejection of feelings of belonging or inclusion, which is an integral component of emotional invalidation (Linehan, 1993). In this experimental condition, the participant received the ball 33% of the time during the first 10 tosses, but following this the participant did not receive the ball for the rest of the game (See figure 3). In the control condition, the participant received the ball 33% of the time during the whole game which a normal inclusionary method in which all three players receive the ball at approximately the same rate.

After the completion of the EEG preparation and Cyberball task, the participant completed the practice block of the task while the experimenter assessed the EEG recording for appropriateness of readings. Finally, the participant completed the flanker task. As aforementioned, the participant was given a short break between blocks. The entire EEG task on average lasted 10-15-minutes to complete (not including break times). After the EEG recording, the experimenter then removed all recording devices from the participant and issued the

Invalidating Childhood Environment Scale (ICES) and the UPPS Scale of Impulsivity. These were randomly ordered. Following this, a deception check and debriefing form containing further details about the current study and contact information was provided. The entirety of the study took approximately an hour.

Results

Descriptive Information

Tables 2-4 provides a summary of the descriptive statistics for the study variables. Prior to conducting hypothesis testing, data were screened for data entry accuracy, multicollinearity, missing values, and outliers. There were no significant outliers in variables of interest and all parametric assumptions were met. However, two participants (one in each group) failed to endorse one item each on the UPPS. As such, these two participants were not included in the statistical analyses for Hypotheses 2 and 3.

Assessing for Pre-existing Differences between Conditions

Groups were checked for unsystematic variance, such as perceived emotional invalidation (measured using the ICES), subscales on the UPPS, and other descriptive information. This was done for two purposes: 1) to ensure that groups were not distinct prior to group assignments and 2) to examine whether factors known to influence EEG data were equally distributed. The ICES total mean difference between the inclusion and control condition, -1.88, 95% CI [-6.98, 3.22], was not significant, $t(32) = -.75$, $p = .46$. Additionally, there were no significant differences between the control and experimental conditions on any of the five subscales of the UPPS ($p > .05$, see Appendix for remaining statistics).

Because this study utilized EEG brain waveform data, certain factors influence the integrity of the results but do not necessarily preclude a participant from completing the study (smoking, caffeine use, previous night's sleep, time since last meal, and exercise habits). None of these five factors were significantly different between groups ($p > .05$, see Table 5). This suggests that equal distribution of these factors were within each group and affected them in approximately the same manner.

Preliminary Analysis

Given that that the purpose of this study was to examine the influences of child emotional invalidation, ostracism, and impulsivity, preliminary analyses were conducted prior to hypothesis testing to examine these relationships. The relationship analysis between perceived childhood emotional invalidation and impulsivity was divided into two levels, trait impulsivity measures (as measured by the UPPS) and state impulsivity measures (Flanker Task and LRP waveform data). Bivariate, Pearson's correlation coefficients were calculated to examine relationship strengths. It was predicted that participants with higher levels of perceived emotional invalidation would perform poorer on the Flanker Task and have a higher peak amplitude and delayed latency of the LRP waveform. Results from this analysis between all variables were non-significant ($p > 0.05$).

The relationship between trait impulsivity and perceived emotional invalidation, were also tested using bivariate Pearson's correlation coefficient testing. It was expected that individuals with higher levels of perceived emotional invalidation during childhood would have more impulsivity in emotionally charged states because of the lack of learned emotional control (Waller et al., 2007). Results yielded a positive correlation between perceived emotional invalidation during childhood and Negative Urgency ($r = .44$, $p < .01$), Positive Urgency ($r = .55$, $p < .01$), and Perseverance ($r=.60$ $p < .01$). The other two subscales, Premeditation and

Sensation Seeking, had no significant relationship with perceived emotional invalidation ($p > 0.05$).

Hypothesis Testing

Hypothesis 1. It was hypothesized that participants in the experimental (ostracized/excluded group) condition would display higher levels of behavioral (state) impulsivity during a cognitive task in comparison to the control (non-ostracized/included group) condition when controlling for perceived past history of emotional invalidation (as measured by the ICES). More specifically, participants that were excluded during the Cyberball task were expected to be less accurate and have a delayed reaction time while completing the Flanker Task. As previously mentioned, given previous research examining the relationship between impulsivity and the Flanker's task, only the incompatible Flanker Trials (trials in which the central stimuli is incongruent with the surrounding stimuli) were included in the analyses (Kóbor et al., 2014). Perceived emotional invalidation was included as a covariate due to both being related to negative interaction patterns. In other words, to examine the specific effect of ostracism on the state behavioral measure, the potential contribution of perceived emotional invalidation was removed in the analyses examining accuracy and reaction time. An analysis of covariance (ANCOVA) was first conducted to specifically examine the group effect on task accuracy, while controlling for perceived childhood emotional invalidation. A Pearson correlation between these test variables and demographic variables was conducted to ensure that demographic variables relevant to this study, but not specifically of interest, were not influential of the results. None of the demographic variables correlated significantly ($p > 0.05$) with the test variables for this hypothesis. These results trended towards significance, $F(1, 31) = 3.01$, $p = .09$

(See Table 6), suggesting that the ostracized group had higher mean accuracy scores ($M_{adjusted}$ = .78, 95% $CI_{adjusted}$ [.71, .85]) than the control group ($M_{adjusted}$ = .70, 95% $CI_{adjusted}$ [.63, .77]) . The total variance accounted for by condition after controlling for the effect of perceived childhood emotional invalidation was 8.8% (η^2= .09).

The second portion of this hypothesis was also analyzed using an ANCOVA examining group as the independent variable and reaction time during the Flanker Task as the dependent variable, again controlling for childhood emotional invalidation. Consistent with above, these results were significant, $F(1, 31) = 0.72$, $p = .05$ (See Table 6) and also suggested the control group was faster ($M_{adjusted}$ = 428.76, 95% $CI_{adjusted}$ [400.71, 456.81]) than the experimental group ($M_{adjusted}$ = .467.83, 95% $CI_{adjusted}$ [439.78, 495.88]). After controlling for perceived childhood emotional invalidation, the total variance in incompatible trial accuracy accounted for by condition was 11.4% (η^2= .11).

Hypothesis 2. It is hypothesized that individuals who were ostracized during the Cyberball Task would have higher peak amplitude and delayed peak latency of the ERP wave. To account for perceived childhood emotional invalidation, for the same reason described in Hypothesis 1, specific ANCOVAs were conducted. Also, a correlation was conducted with demographic variables and the test variables. Caffeine use showed a strong correlation with LRP peak amplitude, and as such, it was included as a second control variable. In the first ANCOVA, LRP peak amplitude was included as the dependent variable with condition as the independent variable. This ANCOVA was trending towards significance, $F(1, 29) = 3.69$, $p = .07$, $\eta^2 = .11$, suggesting that the control group ($M_{adjusted}$ = -2.62, 95% $CI_{adjusted}$ [-3.25, -1.98]) had a higher peak amplitude than the experimental group ($M_{adjusted}$ = -1.75, 95% $CI_{adjusted}$ [-2.409, -1.10]). ICES scores did not significantly contribute to group differences, $F(1, 29) = .07$, $p = .80$, η^2 =

.00. In contrast, caffeine use trended towards significance in its relationship to LRP peak amplitude group differences, $F(1, 29) = 6.19$, $p = .06$, $\omega^2 = .06$ The group differences in respect to LRP peak latency was addressed by the second ANCOVA. This ANCOVA was not significant, $F(1, 29) = .37$, $p = .55$, $\eta^2 = .01$, with no significant differences between the control group ($M_{adjusted}$ = 352.86.50, 95% $CI_{adjusted}$ [310.68, 395.04]) and experimental group ($M_{adjusted}$ = 334.84, 95% $CI_{adjusted}$ [291.35, 395.04]).

Hypothesis 3. Hypothesis 3 stated that scores on the UPPS would be predictive of the LRP waveform data. It was predicted that individuals who had higher scores on the UPPS would show increased peak amplitude and delayed peak latency for the incompatible Flanker Trials. This was tested using separate multiple regression analyses examining the trait impulsivity predictor variables from the UPPS (Negative Urgency, Positive Urgency, and Sensation Seeking) and their ability to predict each of the state impulsivity EEG variables, specifically LRP peak amplitude and peak latency. The first regression model was not able to predict LRP peak amplitude, $F(29) = .24$, $p = 0.87$, $R^2 = .02$ (See table 7). As such, all predictive variables were also non-significant in their relationship strength with LRP peak amplitude: Negative Urgency (β = -.24, $p = .43$), Sensation Seeking (β = -.05, $p = .79$), and Positive Urgency (β = .24, $p = .46$).

In the second multiple regression, UPPS measures (above) were also not able to predict the outcome measure of LRP peak latency, $F(29) = 1.62$, $p = .205$, $R^2 = .14$. However, Sensation Seeking (β = .38, $p = .04$) was a significant predictor of LRP peak latency, but Negative Urgency (β = -.13, $p = .67$) and Positive Urgency (β = -.09, $p = .77$) were not significant predictors.

Hypothesis 4. It was speculated that individuals who reported higher levels of trait impulsivity would perform worse on a behavioral inhibition task. In other words, it was expected that individuals with high scores on the UPPS (indicating high self-reported levels of impulsivity) would have lower accuracy and delayed reaction times on the Flanker's Task. Two multiple regressions were conducted with Flanker's Task accuracy and reaction loaded as outcome variables and Negative Urgency, Positive Urgency, and Sensation Seeking UPPS scores as a predictor variable. The first regression found that the UPPS scores did not significantly predict Flanker's Task accuracy, $F(29) = .61$, $p = 0.62$ (See Table 8). None of the three UPPS subscale scores were found to be significant: Negative Urgency ($\beta = -.29$, $p = .34$), Sensation Seeking ($\beta = .18$, $p = .36$), and Positive Urgency ($\beta = .18$, $p = .58$).

To examine the predictive value of the three selected UPPS subscales on Flanker Task reaction time, a second multiple regression was conduction. This regression was also not significant, $F(29) = .46$, $p = 0.71$ (See Table 8). The UPPS subscale scores, Sensation Seeking ($\beta = -.07$, $p = .70$), Positive Urgency ($\beta = -.03$, $p = .93$), and Negative Urgency ($\beta = -.52$, $p = .61$), did not predict Flanker Reaction Time.

Discussion

The intention for the current study was to assess whether measures of impulsivity in non-clinical populations are affected by negative interactions with others during different stages of life. Particularly, childhood experiences involving perceived emotional invalidation by caregivers were evaluated as well as present peer ostracism during collegial years. This study used a multidisciplinary approach in order to test the effects and relationships various measures have with impulsivity. Specifically, this study utilized an ostracism task, a behavioral measure of interference control, clinical measurement of impulsivity, and electroencephalogram (EEG) to measure the Lateralized Readiness Potential (LRP) waveform data. This study found that ostracism seemed to have some influence on participant's performance on the Flanker Task.

Furthermore, the presence of ostracism increased the peak amplitude of the LRP and delayed peak latency suggesting increased impulsivity.

We predicted that impulsivity levels would increase with the presence of ostracism, which was supported. More specifically, it was expected that individuals who were ostracized and those who perceived that they had higher levels of emotional invalidation during their childhood would be more impulsive. To examine this, this study utilized three forms of impulsivity measures and a measure for perceived childhood emotional invalidation. To influence current ostracism, participants in the experimental manipulation were excluded from group involvement during an exclusion task.

Behavioral performance on the Flanker Task was examined based on accuracy and reaction time. Participants who were included were less accurate and also faster to respond to incongruent trials. These results are contrary to what was hypothesized given previous research which has suggested that individuals who are ostracized tend to perform worse on tasks after being excluded from a group (Baumeister et al., 2002). However, in such studies, it was suggested that complex tasks (utilizing logic and reason) are impaired whereas others are not. It is likely that this particular study utilized measures in the latter category. It is likely that this happens because individuals who are included are less likely to monitor their actions because they already have group inclusion. In contrast, the ostracized individuals seemed to increase their self-monitoring. It is possible that this has an evolutionary purpose. Logically, a human that does not have group support will most likely not possess the resources or the strength to overcome adversity. As such, more expenditure is required to complete tasks that could be divided among group members for included individuals. In other words, members of a group can divide tasks which require cognitive resources which results in less individual spending but an alone individual must use only his/her own energy to complete such tasks. Given this, incorrect responses would result in wasted spending of already limited cognitive resources.

As previously mentioned, being excluded from group involvement also showed slower reaction time on the Flanker Task. This behavior is much in-line with the increased accuracy. It is possible that individuals in an inclusion group are not as attentive to extraneous stimuli because they feel that the group is supporting them. Contrastingly, those individuals who feel excluded require more attentiveness to extraneous stimuli because it might provide more information necessary to survival. These individuals do not have support, and therefore, more information needs to be processed by that single person because there is no one else that will help them with it. This finding is much in line with previous research which suggests that ostracized individuals are hypervigilant for malignant stimuli, and therefore, have slower reaction times (Sebastian, Viding, Williams, & Blakemore, 2010). However, as another explanation, other researchers have suggested that this may be due to conservation of energy (Twenge, Catanese, & Baumeister, 2003). In other words, because of the limited resources that a single person can possess it would be necessary for that individual to be a miser to extend the supply.

Another possible explanation for the increased accuracy and reduced reaction time of the ostracized group might be that these individuals go through an emotional regulation process in which they are more motivated to perform better to reduce future exclusion. Previous research shows that social exclusion activates neural pathways related to social pain that is similar to that of physical pain (Eisenberger & Lieberman, 2004). Pain, or prevention of pain, is a strong motivator for behavioral action. This social pain may be sufficiently motivating to take more time to regulate their emotions and behaviors increase accuracy to prevent future occurrences of social exclusion. Indeed, correct responding might be even more rewarding to an individual who is experiencing this increased stress in comparison to those individuals who are included.

EEG recording that took place during the flanker task was examined by measuring the. LRP waveform, which was analyzed by examining the peak amplitude and peak latency of the waveform. Again, the LRP waveform is a known index for selective motor activation (Eimer & Coles, 2003). The present study found that individuals that were included in the experimental task exhibited increased LRP waveforms, suggesting a stronger prepotent response. In other words, individuals who were included were more strongly prepared for future responding. Contrastingly, there were no differences between participants in either group (included and excluded) in the LRP peak latency. This suggests that the correction of the incorrectly prepared response was completed in relatively the same amount of time (Kóbor et al., 2014). This is contrary to what was expected from previous research, which show impulsive individuals tend to require longer periods of time to correct incorrect prepared responses (Eimer & Coles, 2003; Houlihan & Stelmack, 2011; Kóbor et al., 2014).

Between these above findings, the expectation that trait impulsivity would be predictive of LRP waveform data was not supported. The individuals who were included exhibited a stronger prepotent preparation, but did not take significantly longer to correct this regardless of the increased preparedness in comparison to included individuals. Ostracized individuals may prepare themselves to respond to increase their likelihood of seizing each opportunity to gain acceptance into the group, but they do not appear to prepare it strongly which would prevent them from correcting their responses as quickly to gain group acceptance. Those that are included, however, may not require that reduction in prepotent responses because that individual already has inclusion status. The correction time may not exhibit the normally expected delay from excluded individuals because it would be maladaptive to prepare a response in a slower rate. This would increase the amount of time until an individual has a chance to gain acceptance to the group. Which, in turn, may decrease survival odds for that individual (Otten & Jonas, 2013). Previous research has suggested that ostracized individuals deplete cognitive resources more rapidly due to increased likelihood of negative experiences (Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000; Otten & Jonas, 2013; Raine & Lencz, 2000). As behavioral inhibition is a cognitive task, it requires resources that may not be present if an individual has significant depletion due to exclusion. In short, it appears that group inclusion affects levels of impulsivity.

Another major goal of this study was to examine the relationship between different measures of impulsivity with perceived childhood emotional invalidation. This study utilized the Flanker Task and LRP waveform data to examine state characteristics of impulsivity. Impulsivity has been generally described in the past to be a personality trait (i.e., relatively stable over time); however, research has shown that impulsivity is affected by certain situational characteristics (Fleeson, 2007). State impulsivity is described as the level of impulsiveness at a given point given these situational effects (Wingrove & Bond, 1997). In both cases, this study found that the presence of perceived emotional invalidation during childhood did not seem to relate to state impulsivity.

In contrast, we also examined trait measures of impulsivity, as measured by standardized clinical measures, and its relationship with perceived childhood emotional invalidation. These results suggest that perseverance (staying on task regardless of internal states), negative urgency (impulsivity related to negative mood), and positive urgency (impulsivity related to positive mood) are related to the presence of the self-reported childhood emotional invalidation. These three forms of impulsivity are described as an inability to inhibit behaviors or maintain attention during emotional states (Whiteside et al., 2005). Buckholdt et al. (2014) suggested that emotional invalidation towards a child leads to greater levels of emotion dysregulation. This is primarily due to lack of emotion control. As such, perceived emotional invalidation related to these facets of impulsivity are parallel to emotion dysregulation research. Furthermore, Whiteside et al. (2005) found these three scales to be predictive of borderline personality disorder. This disorder is the subject of the majority of emotional invalidation research and has a large portion of its psychopathology related to emotion dysregulation (Herman et al., 1989; Krause, Mendelson, & Lynch, 2003; Linehan, 1993; Selby et al., 2008). This suggests that perceived emotional invalidation plays at least some role in the development of high impulsivity in adulthood. This is important primarily due to the widespread influence of impulsivity as an underlying mechanism of many different disorders (e.g., ADHD, personality disorders, and addictions).

The connection between emotional invalidation with trait impulsivity but not state impulsivity has a number of interesting interpretive considerations. Primarily, this would suggest that perceived emotional invalidation is most influential of impulsiveness when it is present over a long period of time. Personality traits, such as impulsivity, are a host of patterns related to behavior, thoughts, and emotions. Taken another way, impulsivity, as a trait, would be most influenced with repeated exposures to a stimulus. For example, repeated childhood abuse and neglect have been found to be strong predictors of impulsive suicidality in comparison to individuals who had less abuse over time (Braquehais, Oquendo, Baca-Garcia, & Sher, 2010). Given that the purpose of this study is to examine the effects of negative interactions, the comparison of trait and state behavior provides important comparison information. The state measures of impulsivity, as mentioned above, were influenced by ostracism, which was an acute invalidation experience. Regardless of past experiences, the influence of ostracism on current state impulsivity was most influential when ostracism occurred within close temporal proximity. This area of research however, to the writer's knowledge, is limited. Likewise, literature examining the effects of ostracism on impulsivity are sparse. The primary focus of this link seems to be the relationship between ostracism and impulsive aggression (Kashdan & McKnight, 2010; McDonald & Brent Donnellan, 2012; Rajchert, Konopka, & Huesmann, 2016). As previously mentioned, ostracism can be seen as a form of invalidation because it represents a refusal of social inclusion (Zadro et al., 2004). While these studies focused on aggressive impulsivity, the current study found that ostracism is related to impulsivity in a much more global manner. Cross-sectional studies in this area though have shown that emotional invalidation seems to have a stronger effect over time; yet, some effects such as negative affect and immediate physiological responses (e.g., skin conductance) are more pronounced after immediately receiving an invalidating response in comparison to a validating one (Shenk & Fruzzetti, 2011). The influence of perceived long-standing emotional invalidation, however, has been shown a number of times to be related to lack of emotional control, lack of behavioral control, and unstable relationships (e.g., Marshall, Galea, Wood, & Kerr, 2013; Mountford, Corstorphine, Tomlinson, & Waller, 2007; Selby, Braithwaite, Joiner, & Fincham, 2008; Waller et al., 2007). As such, perceived emotional invalidation over a long period of time may influence a more global aspect of an individual, but temporary occurrences of invalidation may influence state impulsiveness to a larger degree.

It was hypothesized in our study that individuals who had higher trait impulsivity would have higher LRP peak amplitudes and delayed peak latency. In other words, the preparation of an incorrect response was expected to be stronger and take longer to correct in trait impulsive individuals. This, however, was not found in this study. Again, our study measured trait impulsivity using standardized survey assessments. As there are many different survey measures that encompass aspects of impulsivity such as personality traits, behavioral inhibition, attentional inhibition, and general executive functioning, finding that the UPPS, a personality trait measure, is not related to LRP waveform data provide evidence that the underlying mechanisms related to the different facets of impulsivity are discrete. The LRP waveform is related to electrical potential over the motor cortex on the contralateral and ipsilateral hemispheres of the brain based on the side of the person's body that is being studied (Kappenman et al., 2012). Impulsivity as a trait is more widespread in the brain as it encompasses portions of the prefrontal cortex, subcortical region, and temporal lobe (Miller & Cohen, 2001; Ruchsow et al., 2008; Sadeh et al., 2013). While selective attention, error monitoring, and behavioral inhibition are related to LRP waveform potentials, the scope is much smaller than that of the larger impulsivity personality trait.

Secondly, the performance results on the Flanker Task were anticipated to be predicted by UPPS subscale scores. Particularly, individuals with higher scores on the UPPS subscales were expected to predict lower accuracy and slower reaction times on the Flanker Task. Results from the study did not support this hypothesis. Instead, we saw that survey measures of trait impulsivity were not predictive of behavioral state impulsivity. Again, this suggests that these two measures of impulsivity may measure different constructs of this behavior. Indeed, the Flanker Task is a measure of interference control and behavioral inhibition (Kóbor et al., 2014). This is a rather specific portion of impulsivity that may not overlap completely with that of the more generalized trait measured by the UPPS. Given the similarities between the two segments of the second purpose, the results of this study suggest that the different forms of impulsivity may not be capturing the same facets of the major construct. The heterogeneous nature of the impulsivity construct has begun to gain attention of researchers; however, thus far, this is a relatively new avenue of investigation (Caswell, Bond, Duka, & Morgan, 2015). Utilization of multiple different modalities to measure impulsivity may be required to examine the general construct, and more importantly, further examination of the specific facets that are captured should be conducted to increase the likelihood of measuring the desired facet of impulsivity for a given research topic.

Limitations

While several findings were noted in the present study, there are several limitations that should be noted. The primary limitation was the sample population used. Participants were exclusively recruited from an undergraduate population at a small southeastern campus (University of South Carolina Aiken). Despite no significant differences between groups in respect to the demographic variables, groups were not matched between gender and race. Specifically, the group of participants who were in the excluded group had a larger percentage of African American and Hispanic participants as well as more males. This is an important consideration because previous research suggests that there are significant differences in impulsivity and handling adversity between different races, genders, and cultures. For example, when examining the effects of ostracism on collectivistic versus individualistic cultures, it was found that participants from more individualistic cultures were more affected by ostracism (Pfundmair et al., 2015). Likewise, research has shown significant gender differences between impulsivity and discipline and between impulsivity and attachment (Chapple & Johnson, 2007) which might affect perceived childhood emotional invalidation and the effects of ostracism. Also, these individuals were non-clinical, and therefore, the range of survey data, peak of LRP waveform data, and performance during the Flanker Task may be reduced.. Given that, it is conceivable that the representativeness of the sample would have been improved if participants were recruited from more than just an undergraduate population. Furthermore, a larger sample size would have likely provided higher power for a more accurate representation of the relationships among the study variables. As many of this study's statistical analyses' results trended towards significance, it is conceivable that these would have be statistically significant given more power.

Another potential limitation is the usage of self-reported recall of perceived emotional invalidation. Given the nature of this study, it was not viable to conduct more objective measures of emotional invalidation. Furthermore, this study utilized a measure of perceived childhood emotional invalidation that has not been verified based on objective, observational data (Mountford et al., 2007). This is a common problem throughout the emotional invalidation research due to its relatively new area of research. As such, it is possible that individuals who completed this scale either overestimated or underestimated the extent of emotional invalidation during this study. Another potential survey limitation was the lack of an emotion regulation measure. Given that previous research has suggested many underpinnings and traits of impulsivity are shared by emotion regulation (e.g., Maedgen & Carlson, 2000), inclusion of an impulsivity measure may have given this study the ability to further strengthen the model.

Because of the nature of this study, which required the usage of an electroencephalogram (EEG), strict participant guidelines were required. This study had a final sample size of 34 participants, but had a total of 64 participants who signed-up on the recruitment program to participate in this study. Of the participants who signed-up, 14 were excluded prior to any data collection and 16 data sets were not included in the final sample due to issues with the EEG data.

The ability to utilize these participants would have increased the power of the sample that was used in the final analysis, but unfortunately, the exclusionary process is important to prevent data with too many artifacts from influencing the final results. Regardless, this limitation should be noted due to the reduction in sample size.

General Conclusions and Future Directions

Despite these limitations, the present study contributes to the literature by examining the relationships between perceived emotional invalidation, ostracism, and impulsivity. Results indicated that the introduction of ostracism increased state impulsiveness in individuals, and higher levels of perceived emotional invalidation were related to higher levels of trait impulsivity. This has potential clinical applications. Impulsivity underlies many forms of psychopathology such as many personality disorders, ADHD, impulse-control disorders, and addictions. This study suggests that perceived childhood invalidation/validation plays at least some role in levels of impulsivity in adulthood. Not having the ability to express one’s emotions does not promote learning of effective control strategies that are used throughout a lifetime. The importance of parent-child interaction therapies is emphasized by these findings. Furthermore, the impact of ostracism on present decision-making impulsiveness was outlined by this study. This suggests that increasing a person’s ability to effectively socialize with peer groups and cope with rejection will decrease that individual’s likelihood to engage in impulsive behaviors that are maladaptive in nature.

Secondly, few studies have integrated self-report, neurological, and behavioral task measures in a combined study. This study integrated all of these measure types when examining impulsivity to gain a more accurate insight into its underlying factors. This study found that these measures may not be capturing the same facets of impulsivity. This is an interesting finding because it may suggest that impulsivity is an amalgamation of topics that should be examined together for whether they are too divergent to be subsumed under the same category. This also has the potential implication of increasing the ability of research to differentiate forms of impulsivity in clinical diagnoses to better understand their underlying mechanisms to increase the efficacy of treatment.

There are several areas of research that should be pursued following this study. One such direction would include exploring the connections of emotional invalidation, ostracism, and impulsivity more extensively. Utilization of clinical and non-clinical populations might allow for greater variability between participants than what was gathered in this study using only a non-clinical population. This may give more insight into the relationship as well as differences between potential subcomponents of impulsivity. Secondly, this study focused on parental interactions and their effects on impulsivity. A child spends a large amount of time at school with their teachers and peers. Examination of these influences on impulsive development might provide insight into this complex relationship of emotional invalidation and impulsivity. Furthermore, this study utilized retroactive recall. This study suggested a number of potential explanations for the effects of ostracism on state impulsivity. Inclusion of an assessment of strategy (i.e., examining what strategies each participant used) after the Flanker Task might provide additional information about this connection. Future studies should consider utilizing a longitudinal research design to understand the interactions between these maladaptive interaction styles and impulsivity. Lastly, future research should be conducted on measure validity and observational measures so that accuracy can be increased when examining emotional invalidation.

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Table 1
Demographics

Characteristic	Inclusion Group	Exclusion group
N	17	17
Age (yrs)[a]		
Mean	19.11	20.19
Range	18-23	18-25
Gender		
Male	2	6
Female	15	11
Race		
White	16	8
Black	1	4
Hispanic	0	3
American Indian/Alaskan	0	0
Asian	0	0
Other	0	1
Relationship Status		
Single	12	11
Married	2	1
In a committed relationship	3	4

[a]One participant only reported gender in the excluded group

Table 2
Descriptive Statistics of Measures Included in Analysis

Measure	Possible Max and Min Range	Inclusion Group		Exclusion group	
		M	*SD*	*M*	*SD*
ICES	14 to 60	28.82	8.49	26.94	5.87
UPPS					
Positive Urgency	14 to 56	26.53	6.33	24.77	8.00
Negative Urgency	12 to 48	28.41	6.32	27.00	5.03
Premeditation	11 to 44	20.65	4.65	20.12	4.26
Perseverance	10 to 40	19.78	3.84	18.24	3.47
Sensation Seeking	12 to 48	33.94	6.79	34.12	8.59

Table 3

Descriptive Statistics for Flanker's Task

Measure	Inclusion Group *M*	Inclusion Group *SD*	Exclusion group *M*	Exclusion group *SD*
Compatible				
Accuracy (%)	93.29	9.67	92.02	8.39
Reaction Time (ms)	382.29	54.11	427.20	40.79
Incompatible				
Accuracy (%)	69.88	17.48	77.71	8.53
Reaction Time (ms)	427.67	68.92	468.93	39.62
Averages				
Accuracy (%)	81.59	12.18	84.55	7.77
Reaction Time (ms)	404.98	60.90	448.07	39.43

Table 4

Descriptive Statistics for EEG Data

Measure	Inclusion Group *M*	Inclusion Group *SD*	Exclusion group *M*	Exclusion group *SD*
Compatible				
Peak	-2.31	1.13	-1.55	.82
Latency (ms)	320.35	79.90	329.29	72.66
Incompatible				
Peak	-2.54	1.50	-1.85	1.06
Latency (ms)	351.88	80.00	340.47	85.10

Table 5
Descriptive Statistics Differences between Groups

Measure	Inclusion Group *M*	Inclusion Group *SD*	Exclusion group *M*	Exclusion group *SD*	Mean Difference	*p*
Participant Gender	1.65	.49	1.88	.33	.24	.11
Age	19.12	1.27	20.19	2.04	1.07	.08
Race	1.94	.24	2.38	1.41	.43	.22
Employment Status	3.00	.51	3.19	1.68	.19	.74
Marital Status	1.82	1.54	2.06	1.77	.24	.68
Time Since Last Meal	2.41	1.55	2.63	1.20	.21	.60
Today's Exercise	1.77	1.12	1.88	.34	.11	.43
Weekly Exercise	2.18	.44	1.75	.58	-.43	.17
Amount of Sleep	3.65	.79	3.69	.48	.04	.86
Caffeine Use	1.71	.47	1.57	.51	-.14	.41
Smoking	1.94	.24	1.88	.34	.67	.52

Table 6

Analysis of Covariance (ANCOVA) Between Condition and Impulsivity Measures with Perceived Emotional Invalidation as a Covariate

Dependent Variable	Inclusion Group (*M*)	Exclusion Group (*M*)	*F*	*p*
Flanker Task				
Accuracy (%)	69.88	77.71	3.01	.09
Reaction Time (ms)	427.67	468.93	.72	.05
LRP				
Peak Amplitude (μV)	-2.54	-1.85	2.70	.11
Peak Latency (ms)	351.88	340.47	.135	.72

[a] Only incompatible Flanker trials and their corresponding EEG segments were analyzed.

Table 7
Multiple Regression Analysis for Variables Predicting LRP Waveform Data

	Peak Amplitude			Peak Latency		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
UPPS Scale						
Negative Urgency	-.058	.073	-.247	-1.805	4.153	-.126
Sensation Seeking	-.009	.034	-.052	4.158	1.960	.384*
Positive Urgency	.045	.060	.238	-1.015	3.429	.087
R^2		.024			.144	
F		.242			1.624	

*p < .05

Table 8

Multiple Regression Analysis for Variables Predicting Flanker Performance Data

Variable	Accuracy *B*	Accuracy *SE B*	Accuracy *β*	Reaction Time *B*	Reaction Time *SE B*	Reaction Time *β*
UPPS Scale						
Negative Urgency	-.007	.008	-.293	-1.668	3.226	-.158
Sensation Seeking	.003	.004	.117	-.558	1.522	-.074
Positive Urgency	.004	.006	.175	-.251	2.664	-.029
R^2		.059			.046	
F		.609			.463	

Table 6

Correlations Between UPPS Subscales and ICES Scores

Variables	1	2	3	4	5	6
1. Positive Urgency	-	-	-	-	-	-
2. Negative Urgency	.80**	-	-	-	-	-
3. Premeditation	.56**	.47**	-	-	-	-
4. Perseverance	.64**	.61**	.63**	-	-	-
5. Sensation Seeking	.35*	.24	.45**	.11	-	
6. Perceived Childhood Invalidation	.55**	.44**	.26	.60**	-.11	-

* $p < .05$, ** $p < 0.01$

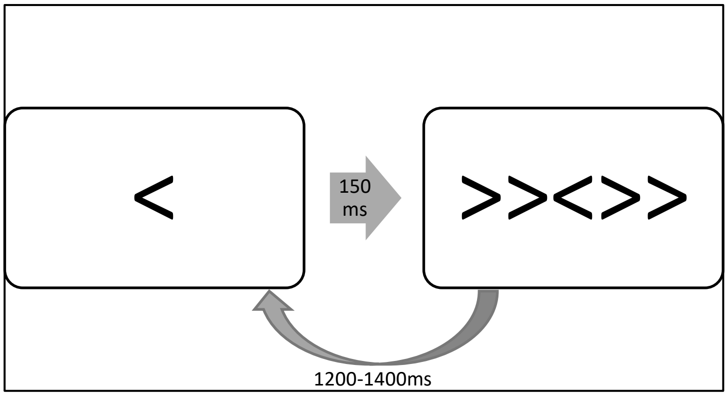

Figure 1: Each of the 10 blocks will contain 40 trials. Each of the trials will have the target stimulus present 150ms prior to the appearance of the flankers. The next trial will begin 1200-1400ms after the previous trial.

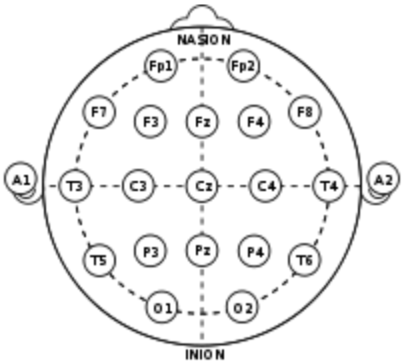

Figure 2: International 10/20 system

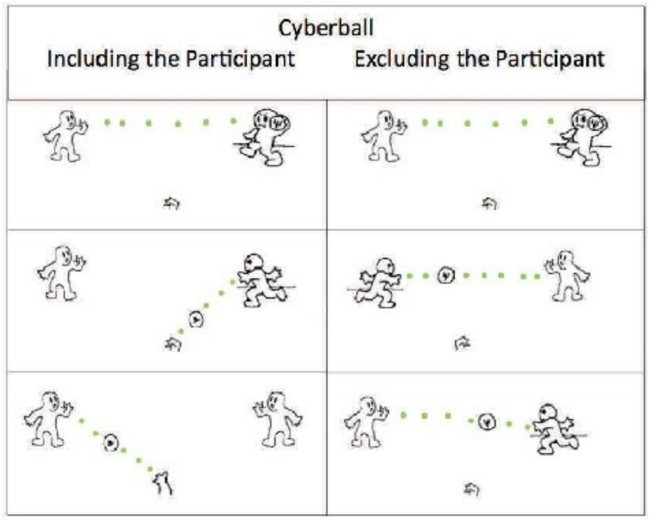

Figure 3: Cyberball conditions

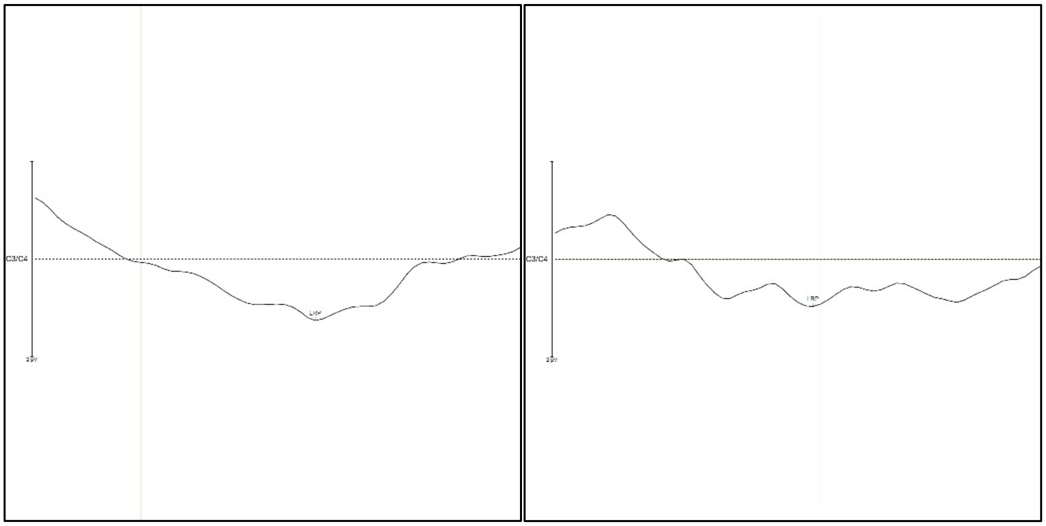

Figure 4: Stimulus-locked grand average ERP waveforms for the incompatible stimulus category collapsed across the C3 and C4 electrode sites. The left figure depicts the grand average waveform for the inclusion group, and the right figure depicts the grand average waveform for the ostracized group. Each window is 150ms surrounding the ERP peak.

Appendix A: Demographics Questionnaire

1) Gender: ________Male ________Female

2) Age: ________years old

3) Race: ________African American ________Caucasian

________American Indian/Alaskan Native ________Hispanic/Latino

________Asian/Pacific Islander

________Other ____________________

4) What is your highest level of education **completed**?

________Less than high school ________High School/GED

________Some College ________2-year degree

________4-year degree ________Master's Degree

________Doctoral Degree

5) Current Employment:

________Full-time ________Part-time

________Self-employed ________Retired or Disabled

________Unemployed

6) What is your current marital status?

________Single ________Married

________Widowed ________Divorced

________In a committed relationship ________Separated

7) When was the last time you have eaten a full meal?

________Less than 4 hours ________Less than 8 hours

________Less than 12 hours ________More than 12 hours

8) Have you exercised today?

________Yes ________No

9) How often a week do you exercise?

________0-1 times ________2-3 times

________4-5 times ________6+ times per week

10) How much sleep did you receive the night before the study (in hours)?

________0-2 hours ________2-3 hours

________4-5 hours ________6+ hours

11) Have you consumed caffeinated food or drinks the day of the study?

________Yes ________No

12) Do you smoke?

________Yes ________No

13) Are you left-handed or right handed?

________Left ________Right

Appendix B: UPPS-P

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree somewhat** circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below. Also, there are questions on the following pages.

		Agree Strongly			Disagree Strongly
1	I have a reserved and cautious attitude toward life.	1	2	3	4
2	I have trouble controlling my impulses.	1	2	3	4
3	I generally seek new and exciting experiences and sensations.	1	2	3	4
4	I generally like to see things through to the end.	1	2	3	4
5	When I am very happy, I can’t seem to stop myself from doing things that can have bad consequences.	1	2	3	4
6	My thinking is usually careful and purposeful.	1	2	3	4
7	I have trouble resisting my cravings (for food, cigarettes, etc.).	1	2	3	4
8	I'll try anything once.	1	2	3	4
9	I tend to give up easily.	1	2	3	4
10	When I am in great mood, I tend to get into situations that could cause me problems.	1	2	3	4
11	I am not one of those people who blurt out things without thinking.	1	2	3	4
12	I often get involved in things I later wish I could get out of.	1	2	3	4
13	I like sports and games in which you have to choose your next move very quickly.	1	2	3	4
14	Unfinished tasks really bother me.	1	2	3	4
15	When I am very happy, I tend to do things that may cause problems in my life.	1	2	3	4
16	I like to stop and think things over before I do them.	1	2	3	4
17	When I feel bad, I will often do things I later regret in order to make myself feel better now.	1	2	3	4
18	I would enjoy water skiing.	1	2	3	4
19	Once I get going on something I hate to stop.	1	2	3	4
20	I tend to lose control when I am in a great mood.	1	2	3	4

		Agree Strongly			Disagree Strongly
21	I don't like to start a project until I know exactly how to proceed.	1	2	3	4
22	Sometimes when I feel bad, I can’t seem to stop what I am doing even though it is making me feel worse.	1	2	3	4
23	I quite enjoy taking risks.	1	2	3	4
24	I concentrate easily.	1	2	3	4
25	When I am really ecstatic, I tend to get out of control.	1	2	3	4
26	I would enjoy parachute jumping.	1	2	3	4
27	I finish what I start.	1	2	3	4
28	I tend to value and follow a rational, "sensible" approach to things.	1	2	3	4
29	When I am upset I often act without thinking.	1	2	3	4
30	Others would say I make bad choices when I am extremely happy about something.	1	2	3	4
31	I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	1	2	3	4
32	I am able to pace myself so as to get things done on time.	1	2	3	4
33	I usually make up my mind through careful reasoning.	1	2	3	4
34	When I feel rejected, I will often say things that I later regret.	1	2	3	4
35	Others are shocked or worried about the things I do when I am feeling very excited.	1	2	3	4
36	I would like to learn to fly an airplane.	1	2	3	4
37	I am a person who always gets the job done.	1	2	3	4
38	I am a cautious person.	1	2	3	4
39	It is hard for me to resist acting on my feelings.	1	2	3	4
40	When I get really happy about something, I tend to do things that can have bad consequences.	1	2	3	4

		Agree Strongly			Disagree Strongly
41	I sometimes like doing things that are a bit frightening.	1	2	3	4
42	I almost always finish projects that I start.	1	2	3	4
43	Before I get into a new situation I like to find out what to expect from it.	1	2	3	4
44	I often make matters worse because I act without thinking when I am upset.	1	2	3	4
45	When overjoyed, I feel like I can't stop myself from going overboard.	1	2	3	4
46	I would enjoy the sensation of skiing very fast down a high mountain slope.	1	2	3	4
47	Sometimes there are so many little things to be done that I just ignore them all.	1	2	3	4
48	I usually think carefully before doing anything.	1	2	3	4
49	When I am really excited, I tend not to think of the consequences of my actions.	1	2	3	4
50	In the heat of an argument, I will often say things that I later regret.	1	2	3	4
51	I would like to go scuba diving.	1	2	3	4
52	I tend to act without thinking when I am really excited.	1	2	3	4
53	I always keep my feelings under control.	1	2	3	4
54	When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	1	2	3	4
55	Before making up my mind, I consider all the advantages and disadvantages.	1	2	3	4
56	I would enjoy fast driving.	1	2	3	4
57	When I am very happy, I feel like it is ok to give in to cravings or overindulge.	1	2	3	4
58	Sometimes I do impulsive things that I later regret.	1	2	3	4
59	I am surprised at the things I do while in a great mood.	1	2	3	4

Scoring Instructions

This is a revised version of the UPPS Impulsive Behavior scale (Whiteside & Lynam, 2001). This version, UPPS-P (Lynam, Smith, Whiteside, & Cyders, 2006), assesses Positive Urgency (Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007) in addition to the four pathways assessed in the original version of the scale-- Urgency (now Negative Urgency), (lack of) Premeditation, (lack of) Perseverance, and Sensation Seeking. The scale uses a 1 (agree strongly) to 4 (disagree strongly) response format. Because the items from different scales run in different directions, it is important to make sure that the correct items are reverse-scored. We suggest making all of the scales run in the direction such that higher scores indicate more impulsive behavior. Therefore, we include the scoring key for, (Negative) Urgency, (lack of) Premeditation, (lack of) Perseverance, Sensation Seeking, and Positive Urgency. For each scale, calculate the mean of the available items; this puts the scales on the same metric. We recommend requiring that a participant have at least 70% of the items before a score is calculated.

(Negative) Urgency (all items except 1 are reversed)
items 2 (R), 7(R), 12 (R), 17 (R), 22 (R), 29 (R), 34 (R), 39 (R), 44 (R), 50 (R), 53, 58 (R)

(lack of) Premeditation (no items are reversed)
items 1, 6, 11, 16, 21, 28, 33, 38, 43, 48, 55.

(lack of) Perseverance (two items are reversed)
items 4, 9 (R), 14, 19, 24, 27, 32, 37, 42, 47 (R)

Sensation Seeking (all items are reversed)
items 3 (R), 8 (R), 13 (R), 18 (R), 23 (R), 26 (R), 31 (R), 36 (R), 41 (R), 46 (R), 51 (R), 56 (R)

Positive Urgency (all items are reversed)
items 5 (R), 10 (R), 15 (R), 20 (R), 25 (R), 30 (R), 35 (R), 40 (R), 45 (R), 49 (R), 52 (R), 54 (R), 57 (R), 59 (R)

(R) indicates the item needs to be reverse scored such 1=4, 2=3, 3=2, and 4=1.

Appendix C: Invalidating Childhood Environments Scale (ICES)

The following questions address your experiences of how your parent(s)/carer(s) responded to your emotions when you were young. For each item, please choose the rating from 1 to 5 that most closely reflects your experience up to the age of 18years.

1	2	3	4	5
Never	**Rarely**	**Some of the time**	**Most of the time**	**All of the time**

1	My parent/carers would become angry if I disagreed with them	1	2	3	4	5
2	When I was anxious, my parent/carers ignored this	1	2	3	4	5
3	If I was happy, my parent/carers would be sarcastic and say things like: “What are you smiling at?”	1	2	3	4	5
4	If I was upset, my parent/carers said things like: “I'll give you something to really cry about!”	1	2	3	4	5
5	My parent/carers made me feel OK if I told them I didn't understand something difficult the first time	1	2	3	4	5
6	If I was pleased because I had done well at school, my parent/carers would say things like: “Don't get too confident”	1	2	3	4	5
7	If I said I couldn't do something, my parent/carers would say things like: “You're being difficult on purpose”	1	2	3	4	5
8	My parent/carers would understand and help me if I couldn't do something straight away	1	2	3	4	5
9	My parent/carers used to say things like: “Talking about worries just makes them worse”	1	2	3	4	5
10	If I couldn't do something however hard I tried, my parent/carers told me I was lazy	1	2	3	4	5
11	My parent/carers would explode with anger if I made decisions without asking them first	1	2	3	4	5
12	When I was miserable, my parent/carers asked me what was upsetting me, so that they could help me	1	2	3	4	5
13	If I couldn't solve a problem, my parent/carers would say things like: “Don't be so stupid — even an idiot could do that!”	1	2	3	4	5
14	When I talked about my plans for the future, my parent/carers listened to me and encouraged me	1	2	3	4	5

Appendix D: Script

Instructions for the Cyberball Task:

1) **Confederate:** “For this task, you will be playing a game of toss with two other participants that are in another lab. You will begin by clicking on one of the other character models on the screen with the left-mouse button. This will throw the ball to them. Following this, the participant that is now holding the ball will click on either the other participant or you. This will continue for 30 tosses. Do you have any questions?”
2) **Confederate:** “Okay, before you begin, I am going to see if the other researchers have prepared the other participants. If they are ready, we will begin. When all three character models appear on the screen, you may begin by clicking on either of the other participant’s characters of your choice.”

Appendix E: Manipulation Check

You have nearly completed the study. At this point, we will discuss what the study examined by asking you some questions. Again, the information that you provide here is confidential and will remain anonymous.

1) In your own words, what do you believe the current study was about?

2) What percentage of throws do you think you received during the Cyberball game?

_________%

3) On a scale of 1-10, to what extent were you included by the participants in the game?

1 2 3 4 5 6 7 8 9 10

4) To what degree did you think you were playing other people over the internet?
   a. Not at all likely
   b. Possible, but not likely
   c. Possible
   d. Possible, and fairly likely
   e. Very likely

Appendix F: Debriefing

The Effect of Ostracism and the Influence of Childhood Emotional Invalidation on Impulsivity: An EEG Study

Principle Investigator: Matthew Tyra

Purpose of the Study
Originally, this study was described as a study of the interactions between impulsivity and social interactions on task performance and neurological data. While this is correct, there is another component of this study. This study seeks to understand the link between emotional invalidation, the minimization, punishment, or ignoring of emotions, with several measures of impulsivity. Similarly, while the participants in the Cyberball task were described as real participants, they were computer preprogrammed entities that tossed the ball based on a percentage. The limited disclosure of the nature of the study was required to simulate real interactions between individuals. If, for example, the group that did not receive the ball was alerted that the other players were not people, the feelings of ostracism would be less defined.

This study attempts to provide useful information regarding the effects of ostracism and emotional invalidation on the prevalence of impulsive behaviors.

Final Report
If you would like to receive a report of this study (or a summary of the findings) when it is completed, contact the primary investigator listed below.

Concerns
If you have any questions about the study, or about the deception involved, please feel free to ask the principal investigator now, or at a later time. If you have concerns about this study or your rights as a participant in this study, you may contact the Office of Research Compliance at (803) 777-7095.

Please keep a copy of this form for your future reference. Once again, thank you for participating in this study.

Signature

Contact Information
Dr. Laura Swain
Department of Psychology
Phone Number (Office): 803-641-3422
Email Address: laurasw@usca.edu

Matthew N. Tyra
Department of Psychology
Email Address: mtyra@usca.edu