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Rejection Sensitivity and Attention Deficit Hyperactivity

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Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent neurodevelopmental disorders, affecting around fifty-one million individuals globally (GBD 2015 Disease and Injury Incidence and Prevalence Collaborators, 2016). For decades, ADHD has been primarily characterized by issues with attention, decreased executive function, and hyperactivity. However, ADHD's role in social behavior and emotion, matters that "may be the most important area of human functioning" (Nijmeijer et al., 2008, p. 703), has only been identified relatively recently and remains poorly understood. Specifically, individuals with ADHD are frequently characterized by their poor emotional regulation and social skills, yet there is comparatively little research into the neurobiology of emotion in ADHD minds. This lack of understanding is particularly prevalent in one facet of emotional regulation known as rejection sensitivity (RS), a condition distinguished by a predisposition to anticipate and perceive social rejection as well as heightened emotional response when rejection occurs. Few studies have analyzed the relationship between RS and ADHD, and the existing research often draws contradictory conclusions (Kross, Egner, Ochsner, Hirsch, & Downey, 2007). In order to explain their findings, research that has found a correlation between RS and ADHD typically turns to a "behavioral mediation hypothesis," a theory first proposed by Downey, Freitas, Michaelis, & Khouri (1998). This behavioral mediation hypothesis postulates that RS is not necessarily the result of a natural sensitivity to rejection and the negative emotions it generates, but rather the gradual, learned sensitization to social rejection generated by frequent experiential exposure.

Almost two decades since Downey et al. initially proposed their theory, researchers such as Bondü and Esser (2015) still rely on this hypothesis to

substantiate the correlation between RS and ADHD, postulating that individuals with ADHD, being naturally more aggressive, impulsive, and poorly social, must therefore experience higher levels of social rejection than their peers, prompting this sensitization to rejection. However, this conclusion does not account for several important issues. It overlooks the growing understanding of the neurophysiological component of RS by characterizing it as merely a symptom of social maladaptation. This narrow and perhaps antiquated perception of RS then leads to the overly simplistic conclusion that the higher rates of RS within the ADHD population must then be due purely to the poor social skills of those with ADHD, without accounting for the evidence that suggests an inherent neurophysiological link between the two conditions. While socialization may indeed be an important factor in RS, I argue that individuals with ADHD may also possess a neurological predisposition to RS that is exacerbated by the differing executive and emotional regulation characteristic of ADHD.

Response to rejection can provide several forms of insight into emotion function and regulation in an individual. Nearly everyone has experienced rejection in some form in their lives, yet Kross et al. (2007) state that there exists a dramatic variation across individuals in how intensely the emotional effects of rejection are felt. While some individuals may be able to remain composed after experiencing rejection, other individuals seem less capable of regulating their negative emotional response (Kross et al., 2007), perhaps becoming aggressive, destructive, or withdrawn to the point of harming their existing relationships or otherwise negatively affecting themselves. For example, while a child with low RS might eagerly engage with a playmate, one with high RS might shy away, avoiding a seemingly positive interaction for fear of being pushed away. Even a mild sign of rejection such as reluctance to share a doll or toy that would be simply brushed off by a child with low RS might lead a child with high RS into an emotional meltdown. In order to better understand this disparity in response to rejection, Downey and Feldman (1996) introduced RS as a metric of susceptibility to negative social experiences. According to their theory, this hypervigilance to perceived signs of social rejection and the atypically intense emotional response that follows it is a learned process. Specifically, frequent, intense, or otherwise significant experiences of social rejection condition individuals with high RS to expect further rejection. This learned anticipation of ostracism then results in higher rates of social withdrawal and anxiety, which in turn increase the likelihood of actually experiencing rejection. In this sense, RS can be thought of as a self-fulfilling prophecy:

individuals with RS are more likely to encounter rejection by virtue of having the condition, further reinforcing their sensitization to rejection. This learned quality of RS is the central construct of Downey et al.'s (1998) behavioral mediation hypothesis.

Though individuals with ADHD are known to exhibit several of the symptoms associated with social dysfunction disorders like RS, how precisely these disorders actually exist in conjunction with ADHD remains unclear (Nijmeijer et al., 2008). Further complicating research efforts, the distinction between these behavioral disorders and ADHD itself is often unclear. While research by Bondü and Esser, (2015) among others, has found that individuals with ADHD have higher self-reported and observed RS, there are few studies that have specifically targeted rates of RS in people with ADHD. However, there is a large body of research that details behavioral dysfunction and rejection patterns for individuals with ADHD, despite not utilizing the specific terminology of RS. Research by Gillberg et al. (2004) has concluded that children with ADHD are far more likely to be disruptive, withdrawn, or aggressive, behavioral patterns that they say are highly correlated to social rejection.

This characterization of individuals with ADHD as socially dysfunctional likely contributes to the ubiquitous use of the behavioral mediation hypothesis to explain the correlation between RS and ADHD. Initially, the behavioral mediation hypothesis seems to be a tidy explanation for this phenomenon: if RS is learned through negative social experiences, and individuals with ADHD have more frequent negative social experiences than is the norm, it only seems natural for those with ADHD to develop higher rates of RS. Therefore, individuals with ADHD are not actually sensitive to rejection by virtue of having ADHD, but sensitized through their frequent experiences of rejection. Several studies such as ones by Downey et al. (1998) and Kross et al. (2007) provide empirical data to demonstrate that individuals both with and without ADHD who *already* possess a high level of RS experience more frequent social rejection. However, there is little to no quantitative literature providing evidence that individuals who *do not already* have RS actually develop sensitivity when faced with rejection. In the existing literature, a close analysis of the qualifying language that researchers use when specifically referring to how RS actually develops reveals that though the behavioral mediation hypothesis is widely discussed, it has not yet been tested. In their conclusion, Bondü and Esser (2015) state that RS “is assumed” (p. 188) to be developed through past experiences of rejection, making it clear that while the behavioral mediation hypothesis may not be unfounded, it cannot be treated as anything more than an assumption.

While individuals with ADHD generally experience more social maladaptation, it is not sufficient to assume that the correlation between RS and ADHD is purely due to negative socialization because individuals with ADHD also exhibit increased sensitivity to positive emotion (Musser et al., 2013). The behavioral mediation hypothesis presumes that individuals with ADHD are not inherently sensitive to emotion, but rather become sensitized through social experiences. According to this hypothesis, individuals with ADHD have less frequent positive experiences than those without the disorder and therefore are not sensitized to positive emotions. However, there is significant evidence suggesting that individuals with ADHD have increased sensitivity to all emotion, especially in regard to positive stimuli (Hwang et al., 2015), a conclusion with important ramifications. The fact that individuals with ADHD are hypersensitive not just to negative emotions, but to positive emotions as well, contradicts the sensitization postulate of the behavioral mediation hypothesis. Therefore, it is clear that the emotional sensitivity associated with ADHD cannot be acquired merely by virtue of social circumstances. Instead, since individuals with ADHD have difficulty regulating both negative and positive emotions, it seems likely that some inherent predisposition to emotional sensitivity exists simply by virtue of having ADHD, regardless of any learned or environmental conditions.

Not only does the behavioral mediation hypothesis's reliance on emotion sensitization present these logical contradictions, it overlooks the growing scientific evidence that links diminished executive function in ADHD to emotion dysregulation and sensitivity purely in terms of neural circuitry. Individuals with ADHD but with no diagnosed comorbid disorders such as RS demonstrate a reduced activity in the lateral prefrontal cortex (LPFC) and ventrolateral prefrontal cortex (VLPFC) in executive function and attention tasks (Ronel, 2018). The reduced recruitment of these regions in the PFC has been frequently associated with the disruption of executive attention as a primary characteristic of ADHD. However, while many studies only analyze the PFC's role in executive function, Passarotti, Sweeney, & Pavuluri (2010) have demonstrated that after the primary emotional appraisal by subcortical regions of the brain involved in generating emotions such as the amygdala, cortical areas such as the PFC are activated in order to mediate the intensity of this response. This pathway is typically described as "top-down" emotional reappraisal. In this sense, the PFC plays a primary role in one's ability to regulate emotions, a role that is disrupted in individuals with ADHD. This is supported by fMRI studies testing for both negative and positive emotions by Hwang et al. (2015) which have

demonstrated that lowered activity in these same regions supports the presence of a magnified emotional response. Specifically, for patients with ADHD, Passarotti, Sweeney, & Pavuluri (2010) concluded that reduced VLPFC activation could indicate under-activation of pathways involved in emotion regulation, thus prompting higher innate emotional sensitivity.

In order to better analyze how the neurophysiology of emotion regulation in ADHD interacts with RS, it is more effective to characterize RS in terms of neurobiology than in terms of environmental conditioning to allow for a comparison of the functional mechanisms in both disorders. While many studies on RS focus on observable patterns of behavior, and often analyze RS in conjunction with another behavioral disorder, few studies, such as the one by Kross et al., (2007), have actually investigated the neural mechanisms behind RS in patients without comorbidity. Their study, which compared individuals with high RS to individuals with low RS, found different levels of recruitment in the left LPFC when observing images of social rejection. Specifically, this study discovered that individuals with low RS had more activation in the LPFC than those with high RS, leading to the conclusion that higher levels of LPFC engagement were likely involved in the mediation of negative emotional response, seemingly diminishing the intensity of the effects of rejection. These same results were supported by research by Ochsner, Bunge, Gross, & Gabrieli (2002), providing further evidence that the LPFC's ability to regulate emotion is disrupted in individuals with RS. Based on these studies, it is clear that RS is not merely a pattern of behavior, but a quantifiable neural condition with specific identifying patterns of activity. Specifically, these findings indicate diminished ability on the part of individuals with RS to initiate cortical mediation of subcortical emotional rejection responses. This inability to initiate cortical to sub-cortical "top-down" regulation for those with RS is the same physiological pattern of activity that can be found in individuals with ADHD.

This pattern of diminished LPFC activation is consistent across individuals with RS without ADHD studied in Kross et al., (2007), and individuals with ADHD without RS or any other behavioral disorder studied in Hwang et al. (2015) and Ronel (2018). These findings indicate that lowered activity in the LPFC limits an individual's ability to regulate their emotional response independent of environmental factors. In their analysis of how emotionally charged distractions affect individuals with ADHD, Vetter et al. (2018) state the LPFC is one of the primary areas involved in cognitive control, specifically, emotion reappraisal. Hwang et al. (2015) have determined that increased signal transmission between the amygdala and

the LPFC in individuals with ADHD could indicate stronger “bottom-up” emotional processes that may also contribute to hypersensitivity. However, the majority of the literature on emotional processing in ADHD has focused on and identified this deficient pattern of LPFC “top-down” emotional regulation. In other words, both ADHD and RS independently demonstrate this feedback loop of diminished “top-down” cortical control and increased “bottom up” subcortical activity. When described in these terms, it is clear that the two disorders share a deeper biological connection than the behavioral mediation hypothesis presumes, one that explains several of the functional similarities between the two conditions.

These similarities between RS and ADHD extend beyond the realm of emotion regulation, with evidence that high RS results in disrupted attention and focus even in individuals without ADHD, further demonstrating that the two conditions possess interrelated neurophysiology that results in their high rates of comorbidity. This can be seen in a study by Berenson et al. (2009) which conducted two tests that determined that RS, even in isolation from ADHD, disrupts focus and sustained attention. According to this study, RS increased not only the rate at which attention was disrupted by social threat cues, but also the disruption of sustained, task-oriented attention. In this sense, while the neurophysiology characteristic of ADHD seems to inherently cause a predisposition to diminished emotional regulation, the neurophysiology of RS also disrupts attention, further blurring the biological distinction between the two conditions.

Indeed, it becomes unclear where exactly RS begins and ADHD ends, complicating diagnoses. ADHD has one of the highest rates of comorbidity of any developmental disorder. The overwhelming majority of individuals with ADHD actually exhibit one or more other diagnosable disorders according to a summary of relevant literature by Gillberg et al. (2004). This literature demonstrates that, as with many other conditions, ADHD and RS share a delicately intertwined pattern of neurological similarities that is rooted in the innate biology of an individual’s mind, a connection that cannot be explained in full by the behavioral mediation hypothesis. Beyond its oversimplification of these issues, the hypothesis also seems to place a degree of fault on the individual. It implies that individuals with ADHD must have elicited such frequent or intense rejection by virtue of their inadequate social skills, erasing the possibility that they may simply possess a natural sensitivity to emotion. This has profound implications for understanding how individuals with ADHD might best be treated in educational settings, by counselors, family, peers, or even society as a whole. Indeed, there are

currently no emotion-related criteria for ADHD diagnosis, despite the accumulating evidence that emotion sensitivity is a common problem for individuals with ADHD (American Psychiatric Association, 2013). Regardless of the origin of emotion dysregulation, awareness of its connection to ADHD should be increased so that individuals with ADHD can both receive a better quality of care and attain a better understanding of this condition and its influence on their lives.

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