ADHD, Willpower, and Interest: A Positive Approach

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Advisor: Leona Brandwene

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that typically presents with challenges of attention, impulsivity, self-regulation, memory, and sometimes, physical restlessness. Many practitioners, as well as the general public, often treat ADHD as a "disorder" that needs to be "cured," and precious few researchers and practitioners look to understand and work *with* the ADHD nervous system rather than trying to align it to the "norm." This paper will examine ADHD from a positive focus: that it is a nervous system that works extremely well as long as certain criteria are met. It will examine what ADHD is, where its unique challenges lie, and present a model of ADHD where the brain of the individual requires more interest-driven stimulation than a neurotypical brain in order to operate at its best. Positive psychology will be proposed as an essential component in any work with individuals with ADHD. Then, using the scientific debate around willpower failure (a common ADHD challenge), four differing theories of why willpower may fail will be examined and explored from the positive ADHD perspective of interest level, rather than as a dysfunction. This exploration may offer a new understanding of willpower that could greatly benefit people with ADHD, and potentially the non-ADHD population as well.

Keywords: ADHD, ego depletion, executive function, interest, willpower, positive psychology, mindset theory, autonomous self-regulation, shifting priorities model, I Model

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Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that effects approximately 5-10% of school age children and 3-5% of adults (American Psychiatric Assocation, 2013; Fayyad et al., 2007; Kessler et al., 2006; Willcutt, 2012), and typically presents with challenges of attention, impulsivity, self-regulation, memory, and sometimes, physical restlessness. In a young adult follow up of a previous longitudinal study, Barkley and Fischer (2019) used actuarial methods to assess the estimated life expectancy of the participants with ADHD. In an analysis of 202 participants (131 hyperactive and 71 controls), they identified 14 health and lifestyle variables from the study that aligned with the required variables for analysis in an actuarial Estimated Life Expectancy Calculator. A number of these required variables are also associated with an increased risk of mortality in untreated ADHD, such as weight, driving record, sleep habits, diet, smoking, and alcohol consumption. Their analysis found that untreated ADHD that persisted into adulthood led to at least a 13-year reduction in estimated life expectancy, with that number increasing when more of those 14 variables impacted the score in a negative direction. If these results are accurate, untreated ADHD potentially brings not only functional and psychological challenges, but significant implications for health and longevity. The authors go on to propose that a combination of pharmacological intervention and either cognitive behavioral therapy or adult ADHD coaching could reduce ADHD symptomology and increase life expectancy in the process.

Given the magnitude of the impact on physical health and the profound behavioral weaknesses that are associated with ADHD, many practitioners, as well as the general public often treat ADHD as a “disorder” that needs to be “cured.” The word “disorder” is embedded in the name and there are, indeed, profound weaknesses that can create dysfunction or challenge in

different domains of life. Medical remediation is important to compensate for neurochemical differences that can exacerbate some of the weaknesses. However, it is only a part of the solution. Some ADHD traits can also be seen as valuable strengths, depending on the context. For example, while impulsivity may not be an asset in a business meeting, on a date it could be seen as spontaneity and become highly prized. Precious few researchers and practitioners look to understand and work *with* the ADHD nervous system rather than trying to align it to the "norm." As we ADHD coaches always say, "the pill doesn't give you the skill." With the advent of positive psychology and its focus on what is best in people and what is working, rather than simply focusing on illness, this paper will examine ADHD from a positive focus: that it is a nervous system that works extremely well as long as certain criteria are met. This paper will begin with an examination of what ADHD is, where its unique challenges lie, and present a model of ADHD where the brain of the individual requires more interest-driven stimulation than a neurotypical brain in order to operate at its best. Next, positive psychology will be proposed as an essential component in any work with individuals with ADHD. Using the scientific debate around willpower failure (a common ADHD challenge), four differing theories of why willpower may fail will be examined and explored from the positive ADHD perspective of interest level, rather than as a dysfunction that needs to be fixed. This exploration may offer a new understanding of willpower that could greatly benefit people with ADHD, and potentially the non-ADHD population as well.

What Is ADHD?

According to the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-V; American Psychiatric Assocation, 2013), ADHD can present clinically in three different ways: primarily inattentive, primarily hyperactive/impulsive, or combined. Inattentive symptoms

include trouble following through, distractibility, trouble organizing and initiating action, difficulty sustaining mental effort, forgetfulness, etc. Hyperactive/impulsive symptoms include excessive fidgeting, the inability to remain quietly still, blurting, excessive talking, interrupting, intruding into conversations, and trouble waiting for their turn, among others. The combined type presents with both types of symptoms. For a formal diagnosis, children must display at least six symptoms while adults must display at least five. The symptoms must be recognized before the age of twelve, appear in more than one domain (e.g. work, home school, etc.), and must have a significant negative impact on the individual's life (American Psychiatric Assocation, 2013).

It is important to note that while current estimates find that ADHD will persist into adulthood in at least 50% of patients diagnosed as children, the percentage is potentially much higher and would require sustained treatment into adulthood (Barkley, Murphy, & Fischer, 2010; Faraone et al., 2015; Volkow & Swanson, 2013). This higher percentage is probable for a number of reasons. First, while the DSM-V criteria includes language about adults, they were primarily designed for use with children and may not be as applicable for adults, or symptomology may present differently in adulthood (Barkley & Fischer, 2019). Second, ADHD in children is diagnosed by report of parents and teachers, while adult diagnosis is by self-report (Willcutt, 2012). Because adult self-report of ADHD symptomology has been shown to be frequently inaccurate, possibly due to ADHD memory issues and lack of self-awareness, the symptomology needed for diagnosis is not properly conveyed by the patient. As a result, the criteria threshold is not met and those patients may mistakenly go undiagnosed and hence, adult diagnoses are very likely underreported (R. G. Klein et al., 2012; Mannuzza, Klein, Klein, Bessler, & Shrout, 2002; Manor et al., 2012; Willcutt, 2012). Third, as individuals age, they may find compensatory strategies or work in an occupation where ADHD traits cause less disruption

or are even beneficial and hence do not seek treatment (Ginsberg, Quintero, Anand, Casillas, & Upadhyaya, 2014; Ramsay, 2017). The DSM-V authors recognize that while an individual may not meet the five-criteria threshold for a formal diagnosis as an adult, there still may be traits that have serious impact on the individual's life and also includes the option for an in partial remission diagnosis (American Psychiatric Assocation, 2013; Faraone, Biederman, & Mick, 2006).

ADHD and Executive Functions

ADHD is commonly seen as a challenge of the executive function system of the brain. For the purpose of our discussion, we will define executive functions as a series of cognitive abilities that allow us to manage a multitude of tasks required in daily life (Brown, 2006). Things like the ability to organize and prioritize tasks, effectively estimate and manage time, maintain and shift focus as needed, sustain effort and inhibit impulses, manage frustration and emotions, and regulate yourself and your actions, are all the magic of your executive functions at work (Barkley, 1997; Brown, 2006).

Though there are many models of executive functions, Thomas Brown (2009), a prominent ADHD researcher and clinician, has created a model of executive function specifically as it relates to ADHD. In his model, Brown has articulated six clusters of cognitive functions that are often challenged in people with ADHD. To understand his model, it is important to note that these six clusters are not measurable units like height or weight, but are instead a variety of cognitive functions that operate in a quickly shifting, dynamic, and often unconscious way, allowing us to do a variety of daily actions and tasks where we must regulate ourselves, manage our attention, and harness memory to direct our actions (Brown, 2006). These six clusters of functions are bundled under the headings of: *activation, focus, effort, emotion,*

memory, and action (Brown, 2005, 2006, 2009, 2013).

Activation. This cluster articulates the functions that are required for an individual to initiate action. These functions include the ability to organize tasks and objects, estimate the amount of time required to do the tasks, prioritize the tasks appropriately, and then actually begin taking action. While many do this quite easily, individuals with ADHD often find organization and task initiation challenging and overwhelming, and end up chronically procrastinating, waiting to start until the very last minute (Brown, 2005, 2006, 2009, 2013).

Focus. This cluster articulates the functions that allows an individual to focus on what they should be focusing on, sustain that focus, and then shift their focus as is necessary and appropriate for task management. People with ADHD often get easily distracted, not only by their environment but also by their own internal thoughts. In other words, an interruption or a novel stimulus can derail their focus, as can ruminative negative thoughts or mind wandering daydreams. One challenging consequence of the frequent loss of focus can cause the individual to have trouble with reading comprehension and they must often reread the material a number of times for understanding (Brown, 2005, 2006, 2009, 2013).

Effort. This cluster articulates the functions an individual uses to regulate alertness and sustain effort. For many people with ADHD, maintaining effort for shorter bursts of time is doable, however they often find it difficult to sustain that effort over an extended period and, as a result, frequently fail to meet deadlines. In addition, regulating sleep and alertness can be challenging. Many people with ADHD will often stay up late, unable to quiet their mind and, once they do finally fall asleep, many find it incredibly difficult to wake up (Brown, 2005, 2006, 2009, 2013).

Emotion. While the DSM-V does not officially list emotional regulation issues as an

ADHD criterion, many people with ADHD have challenges managing emotions like frustration, worry, anger, and disappointment, to name just a few. They often find their emotions seem to take over with a flood of intense feeling, grabbing ahold of them and making it difficult for them to let them go so that they can move forward (Brown, 2005, 2006, 2009, 2013).

Memory. This cluster involves functions related to accessing recall and the use of what is known as *working memory*. Working memory is different than the more commonly known short-term memory. In essence, you use short-term memory when you briefly hold a bit of information in your mind until you can act on it, like remembering a phone number before dialing. Instead, working memory holds a bit of information in mind and processes it while also working and connecting it with other bits of information, and then further connecting it with information retrieved from longer term memory. For example, working memory allows us to listen to someone, process what they are saying in context, while concurrently formulating our response. When reading, it holds the sound of the word's syllables in mind, puts them together coherently while retrieving the multiple meanings of that word, and finally holds that meaning in mind while connecting it to the meaning of the other words. For the average individual, these processes happen extremely quickly and intuitively. However, for people with ADHD, their working memory is often impaired. They will often forget what they were about to say or why they walked into a particular room. They may also forget what someone just said to them, have trouble pulling information they learned out of their memory when needed, and may blurt or talk over people for fear that they will forget what they wanted to say. In addition, as with the focus cluster, reading comprehension may also be impaired (Brown, 2005, 2006, 2009, 2013).

Action. This cluster of functions is responsible for monitoring and regulating our actions. More commonly known as self-regulation or self-control, people with ADHD often find it

difficult to inhibit impulses. They may display impulsive behavior, fail to slow down enough to listen to instructions, or blurt comments without thinking. Unable to monitor and inhibit those impulses, they are often are unaware of the effects that their words and actions have on others. They may not realize that their actions or words have annoyed or hurt someone, and consequently may not change their behavior to match the circumstance. Russel Barkley (1997, 2012); (Brown, 2005) has argued that self-regulation of impulses is the master executive function and the primary challenge of people with ADHD. Brown (2005, 2013), on the other hand, argues that the ability to monitor and inhibit is important but must be viewed in the context of, and in conjunction with, the other executive functions needed to manage daily life and tasks. Thus, ADHD symptoms must be examined as a complex set of processes and not merely as a problem of self-control (Brown, 2005, 2006, 2009, 2013).

While all of us may have challenges in these systems from time to time, like procrastinating or inhibiting an impulse, what distinguishes the person with ADHD is the experience of significant and chronic impairment in these areas, and they suffer significant life impact (American Psychiatric Assocation, 2013; Brown, 2009, 2013). In addition, given the dynamic nature of the interplay of the clusters of functions, ADHD can look quite different from person to person and in differing situations (Brown, 2009). So, how might a person with ADHD look different from someone without ADHD in a typical daily routine?

Functionally, for someone without ADHD, you might plan your day and assemble a number of activities on your to-do list. You assess the level of importance of these tasks and are able to organize your list for both necessary and important tasks. You can realistically estimate how long these tasks should take and then, set your schedule for the day. You don't get overwhelmed because you know you have estimated reasonably well and, barring any

unforeseen interruptions, you are reasonably certain that you will be able to get through your list. Some of these activities may not be very interesting, but cleaning your toilet is necessary because you have guests arriving this evening. You may feel resistance and dread at having to do some of these tasks, but you are able to move through that feeling and start them. You are able to sustain the effort that's required to do them, and you generally stay on task. When doing activities that take mental energy, you are able to sustain that mental energy and not get distracted down a YouTube rabbit hole. If you do get distracted, you realize it relatively quickly and are able to shift your attention back to what you were supposed to be paying attention to.

For the individual with ADHD, that same scenario could look quite different. On a day when they feel particularly motivated, they might sit down to write a to-do list. Just the act of sitting down to write it feels like an accomplishment. At which point, they will begin putting down all sorts of tasks on the list. The problem is all of the tasks feel incredibly important. There's very little distinction between cleaning out your closet and paying the electric bill that was due a week ago, or writing up that report for work that's due the day after tomorrow. They all feel so important that overwhelm quickly sets in. In addition, the thought of doing many of these dull tasks may feel like running into a brick wall and other, more appealing things will jump in and take your attention, and the "just one more YouTube kitten video," can turn into hours of distraction. Further, an absolutely appropriate internet search for a work project can somehow devolve into far afield (but interesting!) topic searches that have nothing to do with the work project and burn hours of precious time. It often will take the intense pressure of a looming deadline or a terrible consequence to finally get them to initiate and sustain activity.

While both of these scenarios are extremes, the importance of executive functions in daily life are undeniable. For the person with ADHD, many seemingly simple tasks can be

exhausting and overwhelming. They rush though tasks at the last minute and berate themselves for not starting earlier. They vow to be better next time and will use their willpower to avoid those evil (but oh-so-adorable) kitten videos. They may think that they are lazy or crazy as they compare themselves to other people, and think that this lack of willpower is a terrible character flaw. However, this is a gross misunderstanding. While the challenges with executive function are clear, there are two other components of ADHD that are critical for a complete understanding of how the different ADHD traits manifest: situational variability and the "interest driven" brain.

Situational Variability

There is a confusing paradox with ADHD that has led many a well-meaning parent, teacher or friend to do unwitting emotional harm to an ADHD impacted individual. There are situations where they can focus, pay attention, stay on task and organize themselves beautifully. However, in other, seemingly similar situations and tasks, they lose focus, procrastinate, jump from task to task, and often find themselves lost in non-essential busy work. People will often say things to them like, "you can pay attention to your video games, you are just being lazy in math class," or, "I saw you do an amazing job on your report for work at the last minute. You just have to stop procrastinating and use your willpower so you can live up to your potential!" Unfortunately, these well-meaning individuals are mistakenly attributing a very real but little-known ADHD element, to a character flaw. That element is known as *ADHD situational variability* (Barkley, 2010; Barkley et al., 2010; Brown, 2009, 2013; Brown, Reichel, & Quinlan, 2009; Volkow et al., 2011). In different situations, ADHD will present differently. In an area of high interest, ADHD traits tend to be relatively low whereas in areas of low interest, ADHD traits tend to be high (Barkley et al., 2010; Barkley, Smith, & Fischer, 2019; Brown, 2005, 2013; Brown et al., 2009). Thus, while playing a game of Fortnite, the teenager with ADHD is

absorbed in rapt attention and can practice for hours but can't focus or sit still long enough to even complete a single homework math problem. While the parents may attribute this to a lack of self-discipline, willpower, or a rebellious nature, from an ADHD practitioner's viewpoint, these two situations are affecting their ADHD very differently due to the differing interest levels.

In addition, in situations where there is an imminent deadline with an immediate and extremely unpleasant consequence, they will also often be moved to action (Brown, 2013; Brown et al., 2009). In this case, the magnitude and immediacy of the consequence is key. That would explain why the report that is being presented to the CEO the next morning gets done while the gas bill deadline gets missed. While the gas bill payment is critical and the potential consequence severe, that consequence is farther off into the future and does not have enough energy to ignite action. This preference for immediate rewards over distanced rewards is called *temporal discounting* and is a cognitive bias that is seen in the general population across the lifespan. However, because of the ADHD propensity towards impulsivity, it is seen significantly more often in people with ADHD (Barkley, Edwards, Laneri, Fletcher, & Metevia, 2001; Luman, Tripp, & Scheres, 2010).

One factor that affects situational variability in ADHD is novelty. Novelty has been associated with a decrease in ADHD symptoms. For example, children with ADHD display fewer behavioral problems in a new environment, but behavior problems increase as the novelty of the new environment wears off (Zentall, Falkenberg, & Smith, 1985). In addition, academic performance can increase with novel materials. In one study, 48 male children ages seven to eleven years old were studied to assess the effect of story novelty on reading comprehension. Participants, all of equal IQ were divided into 3 groups: a group at risk for a reading disability, a group at risk for ADHD, and a normally developing control group. Age appropriate Aesop's

Fables were rewritten to be either low novelty (more familiar characters, fewer active verbs, less vivid adjectives, and more predictable endings) and high novelty (more novel characters, more active verbs and vivid adjectives, and more surprising endings). After reading the stories, the children were then assessed on their reading comprehension. The study found that the children at risk for ADHD performed significantly worse (strong effect size) than non-ADHD children on attention and recall with reading material that was familiar. However, when presented with a novel story, they performed indistinguishably from their non-ADHD counterparts (Beike & Zentall, 2012).

The amount of stimulation the environment or task provides can also alter how ADHD presents. For example, very stimulating educational materials improve attention in children with ADHD. In addition, they are also less impulsive in high stimulation environments, and while performing highly stimulating tasks (Antrop, Roeyers, Van Oost, & Buysse, 2000; Antrop et al., 2006; Lee & Zentall, 2002). It is important to note that while a stimulating environments and stimulating tasks both can have beneficial effects on the ADHD children, if both the environment and the task are very stimulating at the same time, they may compete with one another, lessening the beneficial effects of the stimulation, and the ADHD traits may reappear. In a study of 17 students between the ages of 8 and 14, all with a primary clinical diagnosis of ADHD, Lee and Zentall (2002) randomly assigned the students to a two by two experimental design of four conditions, low or high task stimulation (either math problems on a computer in simple black and white, or with colors, transitions, and movement) and low or high external competing stimulation (a second screen with either a simple gray screen or one with movement, colors and patterns). Students in the high competing stimulation conditions answered fewer questions and were more physically restless (looked more often at the competing computer screen) than the students in the

low competing stimulation conditions. While much of this research has been done with children, clinicians see the same traits in adults (Barkley, 2010; Barkley et al., 2001; Brown, 2005, 2013). More research with adults would help confirm this.

ADHD, Interest, and Dopamine

The brain of an individual with ADHD needs stimulation and interest in order to ameliorate some ADHD traits. One factor that may account for this need is dopamine. Dopamine is a neurotransmitter in the brain that is involved in a number of functions including physical movement, cognition, sleep, mood, attention, and many others. It is also involved in a number of physical and psychological dysfunctions including Parkinson's disease, Huntington's disease, and schizophrenia (M. O. Klein et al., 2019). A full accounting of all of dopamine's functions are beyond the scope of this paper. Instead, this paper will focus solely on the role it plays in the activation of the reward and motivation centers of the brain (Lieberman & Long, 2018; Volkow et al., 2009; Volkow et al., 2011; Volkow, Wise, & Baler, 2017).

The dopamine reward and motivation pathway of the brain is not focused on the here and now, it is focused on future attainment and wanting more. Lieberman and Long (2018), describe dopamine not as the pleasure or satisfaction molecule, but rather as the anticipation molecule. As we go through daily life, our brains are constantly making predictions about what we will or won't experience in the world so that we can better navigate it. When something unexpected happens, our brains are alerted by dopamine to sit up and take notice. That surprising find of a berry bush, the unexpected water source, or that mysterious and attractive stranger across the crowded room, all stimulate dopamine. It is not the satisfaction of having the berry bush or the mysterious stranger, it is the surprise of finding it. Thus, from an evolutionary standpoint, one of dopamine's jobs was to help us maximize resources that will be available to us in the future, and

to seek out a better life. The surprise of finding a new source of food or water was very beneficial for our survival, and so our brains evolved to seek out the unexpected and to be thrilled when we find it. However, once it is attained, that thrill wanes and dopamine calls us to continue to seek other resources for a better life. Think of it this way: that berry bush was thrilling the first time you find it but after you have passed it three or four days in a row, that thrill wanes. It may be satisfying to know it is there, but the thrill has passed. The bush has become something that we can predict. Thus, dopamine is stimulated by what is known as *reward prediction error* (Lieberman & Long, 2018), or the discrepancy between what we predict a reward will be, and what it actually is.

In modern life, dopamine is what is responsible, in part, for the thrill of new love, it helps keep the artist honing their skill even after they have reached financial success, and keeping retirees pumping nickels into slot machines deep into the wee hours of the morning in Vegas. Thus, dopamine is less about enjoying what you have, and more about seeking out what you want and, as a result, its role in motivation becomes salient (Lieberman & Long, 2018; Volkow et al., 2011).

In a seminal study of ADHD patients, Volkow et al. (2009) over an eight-year period used positron emission tomography (PET) scans to examine dopamine synaptic markers in 53 non-medicated subjects with ADHD and 44 healthy control subjects. They found that there was an association between fewer dopamine receptors in the reward pathway and less dopamine transporter (a protein that facilitates the synaptic flow of the molecule), and symptoms of inattention in the brain of an individual with ADHD. In this study, though they found that there was decreased function in the dopamine reward pathway, they did not measure reward sensitivity, so they could only hypothesize the possibility that the brain of an individual with

ADHD had an impaired reward experience. However, in a follow up study, Volkow et al. (2011) tested their hypothesis. In this study they again used PET scans to measure dopamine receptors as well as dopamine transporter in the dopamine reward pathway of 45 ADHD subjects and 41 control subjects. However, in this experiment they also evaluated motivation sensitivity by administering the Multidimensional Personality Questionnaire (MPQ) and focused on the Achievement scale of the MPQ, which measures aspects of motivational disposition. As before, the ADHD subjects had fewer dopamine receptors and less availability of the dopamine transporter relative to the control subjects, but this time, there was also an association with lower MPQ scores in the trait of motivation. The researchers posited that these reward pathway weaknesses could explain the decreased motivation in the ADHD subjects. In addition, because there is also an association between motivation and the symptom of inattention, they note that these findings are also consistent with the clinical experience that ADHD traits are most prevalent in tasks that are considered uninteresting or mundane. Volkow et al. (2011) found these associations so significant that they suggested that there may be a "need to consider the possibility of including 'motivation or interest deficit' as part of the core pathology of ADHD" (p. 1152).

Given the evidence above, we could therefore describe ADHD as a *deficit of interest,* meaning that when interest is low, ADHD traits tend to be high, but when interest is high, ADHD traits tend to be low (for example: Antrop et al., 2000; Brown, 2005; Giwerc, 2011; Roberts, Milich, & Barkley, 2015). Master ADHD coach David Giwerc (2011) takes it one step further. He recognizes that interest is multifaceted, and thus, for our purpose, he defines interest as anything that stimulates the brain, positive or negative. This designation of interest as positive or negative is not designed to propose a moral valuation of a particular action but is, instead,

more about alignment with an intention. Interest that is aligned with an intention that moves an individual forward would be considered positive, while interest that distracts or move the individual in a non-aligned or random direction would be negative. Thus, a fascinating hobby, an amazing book, and an interesting class would all be considered positive interest, while worry, stress, anger, frustration, driving too fast, risky behavior, and so on would be negative interests. In other words, while all of these will stimulate the brain of an individual with ADHD, not all of these types of interest are beneficial, nor are they all oriented to move the individual forward positively.

One common question is often raised when it comes to the ADHD orientation toward interest. Often people will ask something like, "but we all procrastinate or lose focus or get bored from time to time, so what makes ADHD different?" While it is true that most of the ADHD traits exist in the general population, the DSM-V emphasizes as one of the diagnostic criteria: the level of life impairment to the individual's life (American Psychiatric Assocation, 2013). As an example, everyone feels sad from time to time, however in order to be diagnosed with clinical depression, the individual must experience these feelings for a sustained period of time that significantly disrupts their life. Similarly, while all people experience boredom, distraction and impulsivity from time to time, these traits must significantly impair the life of the individual and be enduring in nature in order to receive a diagnosis of ADHD. Further, as discussed above, there is a growing body of evidence for a biological difference in the wiring of the brain impacted by ADHD (Barkley et al., 2019; Volkow & Swanson, 2013; Volkow et al., 2009; Volkow et al., 2011). Due to the dopamine pathway deficits, it is also theorized that it takes more reward stimulation for the individual with ADHD to achieve the same amount of reward as a neurotypical brain (Blum et al., 2008). Thus, it would make sense that the brain of an individual

with ADHD would, of necessity, seek out more stimulation in situations of low interest, resulting in the presentation of "symptoms" like distractibility, impulsivity, risky behavior, and the like.

The I Model

To this point we have identified ADHD as a factor of self-regulatory and executive function challenges moderated by level of interest. With that understanding, it would be valuable to articulate a model that practitioners could use as a guide for both inquiry and understanding of their ADHD clients and their symptomology. The *I Model* (Giwerc, 2011) consists of five components that help the practitioner and the client dissect the various factors involved in a presentation of ADHD symptoms. Those components are *interest, inhibition, intention, ignition* and *intuition.*

Interest. As defined above, interest for the Individual with ADHD is anything that stimulates the brain, positive or negative. Things like a passionate project, a last-minute deadline, an exciting video game, or pornography would all qualify as interest. However, not all interest is created equal. For example, an individual may be doing research for a paper and become sidetracked by a tantalizing tidbit that they find interesting but is not completely related to the goal of the paper. For the individual with ADHD, that sparkling bit of novelty can take them down a Google rabbit hole that can burn many hours of research time and end them on a Wikipedia page examining the mating ritual of the tsetse fly. Certainly, interesting and stimulating, but not necessarily valuable for moving toward the goal of that project. Pornography would be another example. Stimulating to say the least, but not necessarily valuable from a goal seeking perspective, (depending on the goal at that particular time!). While interest stimulates, there are other factors that need to be put in place to guide that interest.

Inhibition and intention. The individual with ADHD must then be able to pause and

inhibit their impulses so that they can notice where their interest and attention is going. Giwerc (2011) teaches his clients to pay attention to where they are placing their attention. At regular intervals, the person must be able to pause and examine where their interest is pointing their attention and ask if that direction is in alignment with where their attention needs to be going. In order to judge that alignment, the individual must articulate an authentic, powerful, and purpose-filled intention. That intention will act as a guidepost and criterion for them to measure the type and direction of interest consuming them. If it is not in alignment with their intention, they can recalibrate and reorient towards an action that will serve them better.

Ignition. It is the combination of interest and intention that create a powerful source of motivation and ignition that engages the brain. When the brain is engaged, as we have seen above, ADHD traits tend to be lessened in severity and in some cases, non-existent. Thus, the interplay between positive interest, inhibition, intention and ignition help the individual to work with their brain wiring and move toward their goals.

Intuition. The final factor in Giwerc's (2011) I Model is intuition. Because of ADHD impulsivity and lack of self-awareness, along with the potentially sidetracking effect of bright and shiny interest, these first four steps can take time and effort for the individual to implement. Over time, however, in his experience with coaching clients, he has noticed that as they listen to the messages of their body, they become more and more attuned and skilled at noticing potential "danger zones" where they can be hijacked by their ADHD. Giwerc (2011) characterizes this as an "ADHD intuition" that helps to guide and warn individuals as they navigate everyday life.

While there has been very limited research around the efficacy of adult ADHD coaching, ADHD researchers are beginning to explore this area. As mentioned earlier, Barkley and Fischer (2019) sees the gold standard of ADHD treatment to be a combination of pharmacological

intervention and either cognitive behavioral therapy or ADHD coaching. A full, scientific evaluation of the I Model would be valuable in moving the science of ADHD coaching forward.

What is Positive Psychology?

Renowned psychologist Martin Seligman had a flash of insight after an interaction with his five-year-old daughter, Nikki. In that interaction where Nikki scolded him saying, "if I can give up whining you can stop being a grouch," (Seligman & Csikszentmihalyi, 2000, p. 6) he realized in a deep way that the role of a parent was not to simply correct their child's faults, but, instead, to nurture and magnify their strengths, help them to orient and live their lives around them, and in so doing, helping to buffer them against their weaknesses. In that flash of insight, he also realized that psychology needed to do the same (Seligman & Csikszentmihalyi, 2000).

Since World War II, the focus of psychology had shifted to a primarily deficit-centered model focused almost exclusively on curing mental illness and alleviating suffering. With the founding of the Veterans Administration and the National Institute for Mental Health, psychologists were called to meet the demand of huge numbers of veterans who were experiencing adjustment disorders due to their exposure to the horrors of war. To meet the needs of the time, the focus of psychological research shifted to the treatment and cure of pathology. While huge strides were made toward the remediation of mental illness, little was done to foster or explore what helps people who are basically well, thrive (Seligman & Csikszentmihalyi, 2000). In essence, psychology was focusing most of its energy on a much smaller subset of people's experience. It was bringing people from negative ten to zero, but doing relatively little to take people from zero to ten.

In his presidential address to the America Psychological Association, Seligman (1999) coined the term "positive psychology" and articulated his mission for a reorientation of the

discipline of psychology to include the empirical study and articulation of well-being and what it is that helps individuals, institutions, and cultures to thrive. He also announced that he had formed a network of 18 scientists who were working on issues related to positive psychology to help lead the way in this reorientation. They included the likes of Barbara Fredrickson with her work on the benefits of positive emotion, Ed Diener with his work on the measurement of subjective well-being, and Mihaly Csikszentmihalyi with his study of flow and optimal experience, to name just a few (Seligman, 2018).

One of the early positive psychology research questions arose as a result of an attempt to identify a positive youth development program that could be studied and rolled out nationally (Niemiec, 2018). What Seligman and his team realized during that process was that they needed to first articulate a language for what is best in people before they did anything else. To that end, he assembled a team of 55 scholars across multiple disciplines under the leadership of psychologist Christopher Peterson, to begin a historical review of theological, philosophical, psychological and ethics literature across a 2500 year period to uncover what universally describes the best in people across cultures and time periods (Niemiec, 2018; Peterson & Seligman, 2004). The initial results identified the six virtues of wisdom, courage, humanity, justice, temperance and transcendence that were both universal and cross-cultural. A further expansion of the research to include a broader range of sources included greeting cards, tombstones and even the Klingon Code from Star Trek (Niemiec, 2018). The end result of this exhaustive study produced a list of 24 character strengths that are measurable, universal and scientifically valid. While we all have all 24 of these strengths, each person also has what they call signature strengths. These are strengths that are core to who we are. They feel authentic and essential to us, and instill a sense of energy, excitement and joy when used. Seligman (2002)

considers character strengths to be the core foundation of positive psychology.

Later, Seligman (2012) also went on to create a theory that articulated the core components of a flourishing life. In his PERMA model, he identified positive emotion, engagement, positive relationships, meaning, and achievement as the five factors that, when cultivated, lead to the manifestation of a flourishing life.

In the more than 20 years since the Seligman APA president's address, positive psychology has fostered research and training in multiple domains across the globe (Donaldson, 2020). Positive research has been conducted and continues in fields such as education, neuroscience, public health, economics, healthcare, government, management, organizational scholarship, leadership, and youth development, to name just a few. In addition, training programs have gone beyond just academic scholarship and have branched into applied positive psychology programs with the goal to create an army of positive psychology practitioners across all domains in real-world settings. Seligman (2012) created the first Masters of Applied Positive Psychology program at the University of Pennsylvania that to date has graduated nearly 500 practitioners, and other universities have followed suit ("Penn LPS MAPP," n.d.; "UEL MAPPCP," n.d.). Thus, positive psychology and its focus on what is best in people, fostering well-being globally, and empowering a flourishing life has become firmly entrenched.

ADHD and Positive Psychology

Positive psychology informs well-being coping strategies that can support the individual with ADHD. As we have defined above, the brain with ADHD has a unique need for stimulation by interest, and interest is anything that stimulates the brain, positive or negative. In addition, individuals with ADHD must pause or inhibit their impulse to simply go with the interest and, instead, compare that interest to their intention which, when examined, will ignite action in a

direction that is aligned with where they need to be going (Giwerc, 2011). Simply by looking at the PERMA model, it is easy to see how its elements provide necessary components for the ADHD impacted.

Positive emotion is a cornerstone of well-being theory and a flourishing life. However, research has shown that the human brain is much more affected by negative events than positive ones, a concept called negativity bias (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). For the individual with ADHD, this means that they are going to be much more susceptible to negative interest as the fuel for their brain. Thus, cultivating positive emotion is critical for them. Fredrickson (2001, 2009) has identified ten positive emotions that broaden the mind, expand possibilities, feel good, and counteract negativity. Interestingly, one of them is interest. Positive interest calls forth increased attention, skill building, and an intense urge to explore and take action (Fredrickson, 2001, 2009). These are all critical to focusing and igniting the brain of an individual with ADHD. It is also a critical component in perseverance and grit (Duckworth, 2016), both areas of significant challenge for people with ADHD (Barkley, 1997, 2010; Barkley et al., 2010; Brown, 2013). Thus, positive emotions help stimulate the brain of an individual with ADHD and ignite action.

Engagement is the second component of PERMA. In this state, we go into a deep and focused attention where there is a loss of self-consciousness and the individual merges with the object of attention in a deep state of flow (Csikszentmihalyi, 1997; Seligman, 2012). For the individual with ADHD, engagement and flow are powerful sources of interest that allow them to inhibit distracting impulses and ignite action. The flow state is very similar to the ADHD trait of hyperfocus, a long-lasting period of intense focus and attention where there is often a complete loss of time (Hupfeld, Abagis, & Shah, 2019). The critical distinction here is a powerful, goal

centered alignment for this absorption (Csikszentmihalyi, 1997) what the I Model would call a powerful intention (Giwerc, 2011). Without that, the individual with ADHD may or may not be engaging in the activities that will continue to move them forward. In other words, they could hyperfocus on what they should be doing like writing a paper due tomorrow or instead, on a distraction like video games. Thus, a powerful intention needs to guide engagement. Seligman (2012) suggests the use of signature character strengths as one of those guides. From the ADHD perspective, using your top strengths not only have a natural interest and can ignite action but can also create a powerful intention for engagement in the individual with ADHD.

Positive relationships. Research tells us that they are linked to better health, well-being, happiness and more satisfaction with life (Diener & Seligman, 2002; Gable & Gosnell, 2011). In addition, Chris Peterson (2006), is famous for saying that all of positive psychology can be summed up in 3 words, “other people matter” (p. 249). For the individual with ADHD, social support provides an important source of structure and support. In my experience as a coach, people with ADHD have such a history of disappointing people and feeling broken, they often feel like they must be self-sufficient in order to prove themselves and often don’t ask for help where they need it. Unfortunately, people with ADHD can be infinitely more successful when there are structures or “scaffolds” put in place to shore up some of the ADHD traits that cause dysfunction in their daily life (Mazursky-Horowitz et al., 2018). Often these structures require the active involvement of other people for things like accountability and planning: the administrative assistant that rewrites the memo and reminds the boss she has to get to the airport, the parent who helps the child with the planning and structure of their day and homework, etc. The support of other people is important to everyone, but perhaps even more so for the individual with ADHD as it provides structure and accountability which enables them to focus

on their strengths while mitigating some of their weaknesses. Thus, other people are critical for ADHD success in areas of intention and ignition.

Meaning is found in serving a larger purpose (Seligman, 2012). Meaning gives direction, organization and motivation to your actions, and when what you do is aligned with meaning and purpose, you do it for its own sake (Smith, 2017). In an interesting study among nations, increases in suicide rates were not linked to poverty in those nations but instead to a lack of meaning (Oishi & Diener, 2014). For the individual with ADHD, serving a larger purpose, of necessity, implies that natural interest is involved. In addition, it ignites action, inhibits impulses that would lean them astray and, most importantly, acts as a powerful intention to guide their choices of action. For example, if my purpose is to help students thrive, working on aligned projects will be interesting to me, guide my choice of projects, focus my actions, and motivate me to follow through. Thus, meaning helps satisfy four elements of I Model: interest, inhibition, intention and ignition (Giwerc, 2011).

Finally, *accomplishment* builds flourishing through success and mastery (Seligman, 2012). As we accumulate successes, these successes become reference points that build belief in our own efficacy, engendering hope and encouraging the continued pursuit toward what we want (Magyar-Moe & Lopez, 2015). However, for the ADHD impacted, there is often a problem with memory (Barkley, 2012; Barkley et al., 2010; Brown, 2006, 2009). Because of the negativity bias that is seen in all people, individuals with ADHD have a unique challenge. Because of executive function issues like memory problems and inattention, they often don't pay attention to successes in the moment, have trouble recalling them later, and thus, can't access positive memories of previous successes, only their failures. As a result, they go into new situations only remembering their failures and, subsequently, will often avoid and procrastinate, creating a

vicious cycle of failure and avoidance. That is why it is critically important to help the individual with ADHD pause and savor those memories of success, imbuing them with positive emotions so they will have access to those memories and use be able to use them as reference points in new situations. Thus, remembering accomplishments can create powerful ignition in the brain of an individual with ADHD.

A positive focus and an understanding of ADHD as a challenge of interest might inform a deeper understanding of the willpower failure debate.

Willpower Failure: A New Perspective

The quest to understand willpower and self-regulation failure has spawned decades of research and opened the topic for significant scientific debate. Discourse around willpower failure has been vigorous and, at times contentious. In addition, this topic is of significant importance to individuals impacted with ADHD who often find regulating their behavior and following through in areas of low interest, challenging at best. Further compounding the executive function regulatory challenges, is the mystery of situational variability which can often make an inability to follow through look like a character flaw or laziness. Thus, researchers on the ego depletion theory and the ADHD impacted population have a vested interest in the exploration of willpower failure and, I propose, have much to teach one another.

What if we have been looking at the topic of willpower failure from the wrong perspective? What might happen if we reexamined this topic from a positive lens: not just focusing on the deficit but also focusing on what is working that supports flourishing? As an ADHD coach, I propose that every negative action as a result of negative interest has a positive intention. For example, being distracted and derailed by a dozen YouTube videos has a negative result, but it is the brain's positive intention to create interest and stimulation in that specific

situation. If we seek out the positive intention of an action, we are able to identify the source need and get that source need met in a better way. If we see an ADHD "willpower failure" not as a factor of poor self-discipline, but instead from the perspective of a dopamine-seeking brain with a high need for interest, we can find ways to support the boosting of interest rather than exhorting them to "stop being so lazy." Both the research around ego-depletion as well as the practitioners working with the ADHD impacted could benefit from this new perspective. ADHD is defined with "deficit" in its title and, while there are clearly unique physical challenges that need to be addressed, when the needs of this uniquely structured system are understood, support and interventions change; you can maximize the efficacy of the system by working with it rather than simply fixing. In addition, the study of ego depletion is equally focused on deficit with "depletion" in its title and concentrated on the aspects that fuel willpower "failure." Examining ego "depletion" and willpower "failure" from the positive ADHD lens of a system seeking interest, rather than a failure/deficit perspective may provide a new series of willpower research questions to ask, as well as further support the ADHD impacted.

If we look at ego depletion with an eye towards interest, executive function, and a query about positive intention, all of the theories around willpower failure have a relevant piece of the puzzle.

Theories of Willpower Failure

The inquiry into self-control and why it sometimes fails is not a new topic. In fact, in the New Testament, even Saint Paul laments, "I do not understand my own actions. For I do not do what I want, but I do the very thing I hate" (Romans 7:15, Revised Standard Version). Over the centuries, scholars, philosophers and, more recently psychologists have posited reasons and explanations for why we sometimes fail in our attempts to align our actions with our intentions.

The term self-regulation has been defined as "the ability to alter one's responses based on rules, goals, ideals, norms, plans, and other standards" (Baumeister & Vohs, 2016, p. 68), and is often used interchangeably with terms self-control or, more colloquially, willpower. Thus, whether I am a dieter trying to resist that chocolate cake, an individual trying to control their temper in a political debate, or a student stopping a video game to sit down and write a capstone, all of these actions require me to regulate myself so that I can do what I need to be doing at any given moment. Failures of self-regulation are central in any discussion of ADHD. One prominent and controversial theory related to self-regulatory failures is *ego depletion theory*.

Ego Depletion as a Limited Resource

The original theory of ego depletion posited that all volitional acts of self-control or willpower draw upon some sort of limited resource of energy. Because it is a limited resource, once it has been used, further acts of willpower have less of that resource to draw upon, increasing the likelihood of willpower failure in proximal regulatory acts. Thus, acts of self-control will be more difficult and failure more likely until that resource is replenished which usually occurs after a period of rest (Baumeister, Bratslavsky, Muraven, & Tice, 1998). This process is metaphorically similar to that of a muscle where, after exertion, that muscle must take time to replenish its energy, before being able to perform effectively again. In the original iteration of this theory, the source of this limited resource was not identified nor was it explained how this energy differs from other expenditures of energy.

In one of the first studies of this theory, Muraven, Tice, and Baumeister (1998) designed a series of experiments to study regulatory depletion and set an experimental protocol that many future ego depletion studies would follow. In these experiments, they designed two tasks that both required self-regulation. The first regulatory task was designed to be taxing enough that it

would exhaust the energy source for the willpower action. The second task, different from the first, would again require some sort of regulation. The overarching theory was that participants who performed an initial depleting task would perform worse on a second task than participants who performed a non-depleting first task. In one of their experiments, 58 undergraduates (30 men and 28 women) were randomly divided into three conditions and asked to write down all their thoughts for 6 minutes. One group was instructed to think about a white bear as much as possible, another group was told to suppress any thoughts of a white bear, and the third group was given no specific thought instructions. Upon completion, all participants were asked to complete a series of anagrams (but were not told that they were unsolvable), and told that when they wished to stop, they were to ring a bell. Results found that the participants who were instructed to suppress the thoughts of a white bear, the regulatory exertion condition, gave up sooner on the anagram task than those who did not suppress thoughts on the first task. In another result, participants who were instructed to alter or suppress their emotions while watching a movie, subsequently showed decreased stamina while squeezing a handgrip. These initial experiments suggested that the exertion of self-regulation activities depleted a limited resource, reducing the amount of self-regulatory energy that could be expended on other tasks requiring self-regulation.

Baumeister et al. (1998) coined the term ego depletion to refer to the state of diminished capacity to self-regulate following a previous self-regulatory exertion, and followed up with an additional series of experiments. In one of the foundational experiments, chocolate chip cookies were baked in the laboratory to fill the room with a delicious smell of fresh baked cookies. The table was set up with two different foods, a plate of the cookies and a bowl of radishes. The study group of 67 college students, 31 males and 36 females were instructed to skip a meal and

were then divided into three conditions. In the self-control exertion condition, the participants were asked to eat at least two or three radishes but avoid eating any cookies during the five-minute period where the experimenter was out of the room. In a second condition, participants were instructed to eat two or three cookies but avoid the radishes, (non-self-control condition). After the five minutes were up, participants were given an unsolvable puzzle and were timed to see how long they persisted. The control condition did not have any food manipulation and instead went directly to the task portion of the experiment. Results showed that the group that had to exert their willpower (the radish group) gave up faster on the puzzle than those who did not.

In another experiment, 30 undergraduates (11 males and 19 females) were divided into two conditions. One group was instructed to try not to express or feel any emotions while watching a film clip of either a humorous or sad movie. The other group was told to let their emotions flow. Afterwards, both groups were given a solvable anagram to work on for six minutes. They found that those who were asked to suppress their emotions performed worse on a solvable puzzle than those who did not (Baumeister et al., 1998).

Other results that they discovered in this initial series of experiments included that participants who were given a complex task with a meaningless piece of text were more likely to display passivity after the exertion and that participants who were asked to make meaningful choices showed reduced persistence on subsequent tasks of exertion (Baumeister et al., 1998). In summary the initial research lent credence to the hypothesis that willpower was a limited resource that could be depleted with use.

The strength model. Further refinement to the ego depletion model was made as more research was conducted. Theoretically, this model used the physical strength model, wherein a

muscle depletes from use in the near term, however when it is stressed progressively and repetitively and allowed adequate recovery, it grows stronger over time. Muraven, Baumeister, and Tice (1999) conducted research with 69 college students who were given one of three self-control tasks to practice for two weeks. At the end of that period, the participants who practiced the tasks showed less vulnerability to ego depletion in unrelated self-control tasks and lent credence to the possibility that self-regulation also had a muscle-like quality, where practice improved capacity and performance. In addition, other research found that people who completed a regulated two-month exercise program showed significant improvement in tests of self-regulation as well as self-reports of regulatory improvements in multiple life areas including smoking, stress reduction and alcohol consumption (Oaten & Cheng, 2006). Similar results were found with people who practiced financial monitoring exercises (Oaten & Cheng, 2007), and people who practiced small acts of self-control over a two week period were more successful with smoking cessation and abstained longer than those who did not practice (Muraven, 2010).

Many of the behavioral manifestations of ego depletion are very similar to ADHD symptoms. Impulsivity has been shown to increase in depleted people. Vohs and Faber (2007) found that depleted individuals had a more intense urge to buy thing, and were not only willing to spend more money, but actually did so in an unexpected purchase situation. Underage social drinkers were more likely to exceed their self-imposed drinking limit during times when they had more self-control requirements (Muraven, Collins, Shiffman, & Paty, 2005). Depleted persons have also been found to show more social impulsivity like talking too much or oversharing personal disclosures too intimately (Vohs, Baumeister, & Ciarocco, 2005). Salmon, Adriaanse, Fennis, De Vet, and De Ridder (2016) found that people, especially those on diets, are more likely to buy unhealthy snacks when depleted. Interestingly, they also propose that there are

individual differences in the sensitivity to depletion among individuals. For example, one person might lose their self-control after an hour of studying while it might take another person half a day to reach that same level.

Depletion also seems to effect decision making. Depleted subjects tend to take more risks and are less likely to consider other options in making decisions (Bruyneel, Dewitte, Franses, & Dekimpe, 2009; Freeman & Muraven, 2010; Pohl, Erdfelder, Hilbig, Liebke, & Stahlberg, 2013). In addition, the act of decision-making itself has been found to be depleting. Having to make choices may lead to less persistence when confronted with failure and increases in procrastination. Interestingly, while making a few pleasant choices may not be depleting, making many choices of any type is depleting (Vohs et al., 2014).

As research continued, questions about the completeness of the strength model of ego depletion resulted from studies that found that the effects of depletion could be mitigated. Tice, Baumeister, Shmueli, and Muraven (2007) conducted a series of four experiments and discovered that positive emotion could eliminate the effects of depletion. In one study, 51 introductory psychology students were divided into either a thought suppression condition where they were asked not to think of a white bear while writing down their thoughts for a 5 minute period (depletion condition) or simply to write down their thoughts with no conditions (non-depletion condition). Participants were then either given a surprise gift (positive mood induction) or a receipt for participating (neutral mood induction). They were all then taken to another room where they were asked to drink as many glasses as they could of a healthy beverage that tasted bad. Depleted participants who received the gift performed as well as the non-depleted participant on the beverage task. The researchers hypothesized that the positive emotion eliminated self-regulation impairment.

In other studies, priming participants with motivational phrases in anagrams or on a screen saver lead to improved self-control performance in depleted individuals (Alberts, Martijn, Greb, Merckelbach, & de Vries, 2007), as did priming participants with phrases designed to increase self-awareness (Alberts, Martijn, & de Vries, 2011; Kelly, Crawford, Gowen, Richardson, & Sünram-Lea, 2017). In addition, encouraging self-talk improved selective attention after a depleting task (Jón, Antonis, Evangelos, Nikos, & Athanasios, 2017).

Another mitigating effect seemed to include the level of motivation of the individual. If participants believed that their performance would significantly impact others, in this case help with future Alzheimer therapies, the depletion effect was mitigated. 43 undergraduate students (20 men and 23 women) were divided into a depletion condition (thought suppression) and non-depletion condition (no thought suppression). They were then given an unsolvable puzzle. Those participants in the depletion condition who were also told that their work on this puzzle would help Alzheimer's research performed better than depleted participants that were told nothing (Muraven & Slessareva, 2003). Other studies also found that, if there was direct benefit to the participants themselves in the form of money, or if they used religious concepts as motivation, depleted individuals also performed better on self-control tasks (Muraven & Slessareva, 2003; Rounding, Lee, Jacobson, & Ji, 2012).

In a particularly interesting study of motivation and ego depletion, DeWall, Baumeister, Mead, and Vohs (2011) manipulated a power differential in the form of a leadership role to uncover its effect on ego depletion. After showing in an initial experiment that a leadership role increased self-control generally, 112 participants made up of 81 women and 31 men were told they would be working with a partner to complete a building task later in the study, (actually they would complete the study alone), and that they would be assigned to a role based on their

answers to a leadership questionnaire they were asked to fill out. While the experimenter pretended to score the survey, they were told to watch a silent video of a woman being interviewed that had words flashing at the bottom of the screen. Half of the participants were assigned to the depletion condition, where they were instructed to ignore words flashing in the lower corner, while the non-depletion groups were simply instructed to watch the video. After watching the video, participants in the high-power condition were told that as "managers," they would decide the building process of the task, be able to write a review of their partner's performance on the task, and decide how the bonus money would be distributed. In the low-power condition, "subordinates" were told that they were to follow the manager's instructions, that their performance would be reviewed by the manager, and that they would be given the allotment of the bonus money that the manager deemed appropriate. The control group was told that they would get their role later. They were all then given a self-control listening task. The researchers discovered that a leadership role with high-power counteracted the depletion effect. While this may seem to lend credence to a motivation moderator effect, they also found that there were limits to that effect. Leaders who continued to exert high effort even in a depleted state led to much worse performance later and a seeming willpower depletion rebound effect.

Conservation model and the 'Central Governor' theory. While the strength model of self-control had spawned significant research, questions also arose as to what the biological basis of this metaphorical resource actually was. Gailliot et al. (2007) used nine studies to test the hypothesis that the resource in self-control was actually glucose in the brain. In one of those studies, 103 undergraduates (64 women) were asked not to eat for three hours in order to stabilize their blood glucose. Blood glucose was examined before and after either a self-control condition where they had to ignore the words in the corner of a video or the control condition of

simply watching the video. This study showed that after an exercise in self-control, there was a significant drop in blood glucose levels. In subsequent studies they also found that reduced glucose levels that were linked to an ego depletion effect (Gailliot et al., 2007) and when glucose was manipulated in the form of drinking a sugary beverage, the depletion effect lessened or was eliminated (DeWall, Baumeister, Gailliot, & Maner, 2008; Masicampo & Baumeister, 2008).

In other studies, however, counter evidence also arose to the glucose hypothesis. Molden et al. (2012) studied 44 university students (28 females) who were randomly divided into a high visual vigilance task where they had to follow very specific and complex rules for crossing out letters in the text, and a low vigilance task with very simple, straightforward instructions. After the task, participants were either given a sugary mouth rinse or a sugar substitute mouth rinse. Subsequently, their endurance was measured on a handgrip task. Results found that simply rinsing their mouth with a sugary liquid immediately mitigated the depletion effect even though the beverage was not consumed. Subsequent research found that a glucose mouth rinse lead to improved performance on a depleting task, but had no effect on the performance of non-depleted participants (Hagger & Chatzisarantis, 2012). In a more recent experiment, Zahn et al. (2019) studied 30 healthy university students (15 women) and used a hyperinsulinemic euglycemic glucose clamp, a reliable and validated procedure to measure glucose level while performing a standard dual-task protocol depletion experiment, in this case using the standard crossing out of specific letters in a text. They found no difference in glucose usage between the self-control depletion group and non-depletion controls. However, they also acknowledged that due to the complexity of the procedure with the clamp method, the sample size was small.

Due to the conflicting evidence, it was unclear as to what role glucose actually played in self-control failure. One of the premises that Gailliot and Baumeister (2007) put forth in their

original glucose hypothesis said that glucose could be used in the brain faster than it can be restored and it is that depletion effect that is the result of the observed self-control failure. However, Kurzban (2010) argued that a conservative estimate of region-specific brain glucose usage, even in the most intense activity would probably use no more than 1% of the available brain glucose. Beedie and Lane (2012) offered a hypothesis to bridge the gap. Instead of thinking of self-control failure as the result of the draining of the glucose resources, they propose that it is the result of a selective allocation that the body already does. For example, when we are in a state of fear, the body directs blood flow and nutrients away from digestion and internal organs and sends them to the extremities to meet the potential needs to ward off a frightening situation. They posit the same process occurs in the brain. When the brain uses glucose in a specific task and then anticipates that more will be needed, even though the brain has enough glucose, it will selectively allocate only when it deems necessary based on the individual's personal priorities (ie. important or urgent). Thus, if the self-control activity is prioritized, the brain will instruct the liver to release glucose to maintain the motivation and persist. If, however, the self-control activity takes up too much of the resource or there are repeated self-control efforts, the brain causes motivation towards self-control to be lessened in order to conserve glucose, it reallocates glucose resources to more important functions, and self-control failure results. For example, a dieter in a bakery is resisting their favorite dessert. They love the dessert but losing weight is very important to them. The brain will release glucose to allow them to resist for a while until that level of self-control goes on for too long or the system has multiple self-control demands thrust upon it. In those situations, the motivation to resist will wane so that the glucose can be reallocated, and they will succumb to the temptation.

Beedie and Lane (2012) significantly moved the needle away from the conception that

self-control drew from a limited well of resource that could be depleted to a resource allocation model. While Baumeister and Vohs (2016) accept the premise that the reallocation of resources should be the focus of study, there was still a puzzle as to why the body would activate ego depletion to conserve glucose when there was still more than enough to avoid the risk of running out. Evans, Boggero, and Segerstrom (2015) proposed an addition to the model that came from the world of physical fatigue. They proposed that the ego depletion phenomenon was akin to a muscle beginning to fatigue long before it had exhausted its reserves so that it would no longer function. They built their hypothesis from previous theoretical work (Noakes, 1997) that proposed that there was a central nervous system mechanism dubbed the *central governor* that would limit the exertion of a muscle to avoid total failure and maintain homeostasis. This central governor keeps track of multiple signals like metabolic rate and fuel reserves, and deploys a subjective feeling of fatigue that continues to increase as exertion increases. They propose that the system of self-control works similarly. The central governor is generally aware of the needs of the body and takes into account things like experience, motivation, current workload, anticipated future energy requirements, and the like. Synthesizing all those markers, the central governor then determines when the subjective feeling of self-control fatigue should begin to set in, eventually leading to self-control failure so that it can reallocate the resources to other areas. The elegance of this model brings together both a motivational *and* physical component and would explain that since the actual glucose resource is not depleted, in the presence of sufficient motivation, the individual could potentially continue to persevere. It would also explain why there is a significant depletion rebound effect after forcing self-control, as was observed in the DeWall et al. (2011) study. Thus, the ego depletion theory as it currently stands posits that self-control failure is not the result of a complete exhaustion of the resource but rather a conservation

of remaining resources in the face of potential future needs.

Discussion. As we have seen, there are a large number of studies that definitely show some kind of effect that looks like ego depletion. The common human experience of mental fatigue would seem to validate that our energy gets used up and must be replenished when we force ourselves to push through on demanding tasks. Clearly, however, there is a great deal more involved. We have seen that the depletion effect can be counteracted by such things as beliefs about willpower, positive self-talk, as well as the amount of autonomy an individual has over their tasks and choices, to name just a few. How can we reconcile these seeming contradictions?

As noted earlier, due to a challenge in the dopamine reward pathway, the brain of the individual with ADHD seeks stimulation and interest, and that that interest can be either positive or negative (Giwerc, 2011). In addition, while interest is what stimulates their brain and moves them to action, a powerful and purpose filled intention needs to serve as a criterion to measure that interest against, giving the individual with ADHD the power to recognize when they are being distracted by something that may be interesting but is not in alignment with their goals. Having this criterion allows for improved decision making and potentially better attention management that is aligned with their goals.

Further, the brain of an individual with ADHD also has challenges in the complex clusters of functions that make day-to-day activities possible (Barkley, 2012; Brown, 2006, 2009). Those cluster of functions, as described earlier, include activation, focus, effort, emotion, memory, and action. What is commonly described as self-regulation is a complex interplay of these clusters of functions and, for the individual with ADHD, in situations of low interest, regulatory challenges and ADHD traits with be high, and in situations of high interest, regulatory challenges and ADHD traits will be low.

Ego depletion and ADHD. One of the similarities between ego depletion and ADHD traits is impulsivity, a common trait with ADHD (Barkley, 1997; Brown, 2005, 2009; Brown et al., 2009). Impulsivity is also found in some studies of ego depletion. For example, chronic dieters have been shown to eat more food when depleted (Vohs & Heatherton, 2000), smokers deplete when they resist the urge to smoke (Hagger et al., 2013), and they smoke more when they are depleted (Shmueli & Prochaska, 2012). In addition, people drink more and buy more impulsively when depleted (Muraven, Collins, & Neinhaus, 2002; Vohs & Faber, 2007). Resisting the food, the purchase, or the cigarette, lacks interest. Because resisting is boring, the immediate reward of that great feeling you get when you smoke or the delicious treat that is right there in front of you would sparkle with possibility and interest, urging you to break your resolve. In addition, executive function challenges around memory and decision-making could make remembering your resolve and your goal difficult. Even if you do call to mind how good you will feel when you resist, the immediate gratification of the reward has more value than the delayed gratification (Barkley et al., 2001) and the likelihood of willpower failure may increase. Thus, an ADHD perspective can provide other areas to explore in experimental situations. Examining variables such as levels of dopamine, levels of interest, executive function impairment, and proximity of reward - all factors in ADHD - may offer new insights to the mechanisms involved, and would also be valuable for everyone in a self-control situation.

Factors that negate depletion should also be examined. Positive emotion can negate the effect of ego depletion, as can fiscal and social incentives (Muraven & Slessareva, 2003; Shmueli & Prochaska, 2012; Tice et al., 2007). In addition, a leadership role can also help individuals resist depletion as can positive self-talk (Alberts et al., 2011; Alberts et al., 2007; DeWall et al., 2011). In each one of these cases, what may be compensating for depletion is a

level of interest that increases dopamine. A positive or comic video before a second self-control task (Shmueli & Prochaska, 2012; Tice et al., 2007) could potentially increase dopamine and allow for the better task performance. Money, social incentives, leadership and even positive self-talk can bring attention to something of higher interest than the boring task in front of you, igniting you to persevere, and potentially mitigating the depletion effect. These perspectives suggest that interest and dopamine should also be measured in these studies.

An interesting side note, in the DeWall et al. (2011) study of leadership, one of the experiments found that even though leaders who completed tasks that were usually completed by a subordinate and seen as beneath their status performed well, a surprise additional test showed significantly worse performance afterwards. This would indicate that level of obligation may serve as a factor worthy of study. It may also imply that obligation may only serve as a temporary stopgap measure to fortify willpower and may have a rebound effect. More research around the roles of obligation and duty in self-regulation is necessary.

Ego depletion, glucose and dopamine. As we saw earlier, after being called on to identify the actual resource that is being depleted, ego depletion theory incorporated those criticisms and moved away from the concept that willpower was a limited resource that can be completely depleted, and instead, moved to a theory that posits the experience of depletion after regulatory exertion is the result of a reallocation of glucose resources in the brain by a "central governor" system (Baumeister & Vohs, 2016; Beedie & Lane, 2012; Evans et al., 2015).

As we saw above, dopamine has an important role in the brain's reward pathways, and that the brain of an individual with ADHD may have fewer dopamine receptors and less of the protein that facilitates the transportation of dopamine (Volkow & Swanson, 2013; Volkow et al., 2009; Volkow et al., 2011). As a result, people with ADHD often have an impaired reward

experience, especially in mundane or uninteresting situations or activities. Given the challenges people with ADHD have with willpower in areas of low interest, if ego depletion theory is correct and glucose is involved, dopamine may also be associated in some way.

In a study of obesity, Blum, Thanos, and Gold (2014) have found that there is a relationship between glucose consumption and the stimulation of dopamine. It has also been found that just carbohydrates in the mouth also stimulate the production of dopamine while a sugar substitute does not (Kringelbach, 2004). Further, when an individual engages in an act of autonomous self-regulation (which could be equated with interest), glucose rises (Kazén, Kuhl, & Leicht, 2015). Given that we have seen that dopamine and interest are related, it could further be inferred that dopamine and glucose may also be related in that instance.

In regard to the link between ego depletion and dopamine, in a summary review of research findings, Lorist, Boksem, and Ridderinkhof (2005) have posited that mental fatigue (a potential factor in ego depletion), is the result of the failure to maintain sufficient levels of dopamine in the brains reward pathway. In addition, Dang, Xiao, Liu, Jiang, and Mao (2016) have found an inverted U relationship with dopamine and ego depletion. A medium level of dopamine was found to be a possible buffer against a depletion effect. If levels of dopamine were too low or too high, the ego depletion effect was observed.

If self-regulatory and willpower failure are due, in part, to low dopamine as a result of low interest, the resource that fluctuates may not just be glucose, dopamine may also be involved. Clearly, though more research needs to be done to make a definitive link between ego depletion, glucose and dopamine, it is reasonable to assert that the glucose theory of ego depletion is not incompatible with a dopamine association. Thus, studying the ego depletion effect in conjunction with interest, dopamine levels and glucose may open the door to a new

understanding of other factors involved in willpower failures.

The ego depletion hypothesis continues to be studied and will no doubt continue to evolve. Indeed, with a 20-year history and hundreds of studies, for some scientists it has become the scientific theory equivalent of the "movie villain you love to hate," as this theory is not without its detractors. Three prominent alternate theories – Mindset Theory, Vitality and Autonomous Self-Regulation, and the Shifting Priorities Model – will each be examined, with a discussion to their relationship with ADHD, followed by a proposed synthesis of these theories

Mindset Theory

A number of studies above have shown that the depletion effects can be mitigated by things like financial incentives, religious concepts, positive emotion, and the personal or other person impacts of actions (DeWall et al., 2011; Muraven & Slessareva, 2003; Rounding et al., 2012; Tice et al., 2007). In a now seminal study, Job, Dweck, and Walton (2010) set out to examine if mindset beliefs were involved in the appearance of the ego depletion effect. In a series of three efficacy studies and a longitudinal field study, they set out to see if there was a difference in the ego depletion effects between those who held the belief that willpower was a limited resource and those who held that willpower was an unlimited resource.

In the first study, 60 students comprising of 42 females and 18 males, were given a questionnaire to assess their beliefs about willpower and the effects of mental exertion. Because they were not aware that this study was specifically about willpower beliefs, statements about their beliefs were mixed in with other non-related statements. Statements like, "after a strenuous mental activity your energy is depleted and you must rest to get it refueled again" were used to identify a limited-resource belief while, "your mental stamina fuels itself" and "even after strenuous mental exertion you can continue doing more of it," (Job et al., 2010, p. 1687) to

identify beliefs that willpower was not a limited resource. Subsequently, they were all given a task to induce depletion and followed up with another self-control task where answer accuracy was assessed. As hypothesized, generally the ego depletion effect was present but upon closer analysis, they discovered only participants who believed that willpower was a limited resource actually showed the ego depletion effect.

The second study attempted to identify a causal relationship between mindset and ego depletion. They did so by administering a survey that was written to suggest and lead the participants into either a limited resource belief or an unlimited resource belief. The results confirmed a causal link that belief moderated ego depletion. The participants that were led to an unlimited resource mindset did not experience ego depletion whereas those who were led to a limited resource belief did experience it. There was, however, a very interesting finding. Participants who were led to the mindset that self-control was an unlimited resource, actually did worse on the non-depleting task than they did on the depleting task. The researchers noted, "It is intriguing to speculate that they were depleted by boredom rather than by self-control" (Job et al., 2010, p. 1688). If this were the case, then the role of interest, which is so prominent in ADHD coping around willpower failure, might have served as a mitigating factor.

In the third study, they added two strenuous tasks after the initial depletion task to see if the participants with the unlimited resource mindset overused their willpower resources on the second task and would consequently perform worse on the third task. In addition, after the depletion task, they also asked the participants how exhausted they felt after the first task to introduce the variable of the subjective experience of the participants. Again, limited resource mindset participants showed the ego depletion effect across the following two tasks whereas the unlimited resource mindset participants did not, indicating that the unlimited mindset participants

did not overuse their resources during the second task. In addition, mindset did not affect the subjective experience of exhaustion. In other words, limited resource and unlimited resource mindset participants found the depleting tasks equally exhausting. What was interesting here, however, was that though all participants found the depleting task just as exhausting, the exhaustion only affected the performance of the participants with a limited resource mindset. In other words, all participants were exhausted equally, but mindset determined whether that exhaustion affected performance.

In the fourth study, Job et al. (2010) measured the willpower mindset and self-report of willpower activities of a group of college students over three points in time during the semester. 41 of 101 students completed the survey at all three time points. In the assessment, their willpower resource belief was measured along with questions about how many times they had eaten unhealthy food or avoided studying by doing other activities instead. In addition, at the initial measure, students also identified a challenging achievement goal that they were currently working toward. At the subsequent two assessment points, they were asked how well they had been able to regulate themselves toward achieving that goal. Results showed that willpower resource beliefs determined how likely the students were to be successful in regulating their behavior both generally and in actions toward their stated goal.

Job et al. (2010), taking the results of all four studies together, concluded that mindset beliefs about whether willpower resources are limited or unlimited will affect how an individual will respond and perform to the subjective experience of exhaustion. In other words, if you believe that willpower is a limited resource, that belief will affect your performance in the face of exhaustion, while unlimited willpower resource beliefs will not. They further acknowledge that biological factors do influence self-control, but in some cases, it may not be an actual

resource depletion, but rather a belief about the depletion that is affecting the outcome.

Discussion - ADHD and mindset theory. In the mindset theory, Job et al. (2010) showed that ego depletion was moderated by a belief in willpower as a resource. Those who saw willpower as an unlimited resource did not experience a depletion effect, while those who saw willpower as limited, did, (with one exception which I will discuss below). It is fairly well accepted that thoughts and beliefs can affect our physiology. As just one example, Crum and Langer (2007) studied 84 female room attendants across seven hotels who were measured on physical health variables and divided into two groups. One group was told, and given examples of how, the work they were doing was exercise that met government standards for an active lifestyle, while the other group was told nothing. Though neither group did anything differently, after four weeks the informed group perceived that they were fitter and also showed more physiological health changes like weight loss and reduced body mass index compared to the uninformed group. The researchers concluded that the physical effects of exercise are due, at least in part to a placebo effect. Given that the influence of mindset on the body parallels the physiological effects of a placebo; it is plausible that a mindset, too, could powerfully influence willpower.

However, if we look from an ADHD perspective, there are additional factors that may be involved. As we have seen above, individuals with ADHD have challenges in executive functions such as being able to focus, organizing and prioritizing, emotional management, and the like. In addition, situational variability, as well as level of interest, are factors that have not yet been measured in these studies, but quantifying their influence would provide insights for individuals with ADHD. For example, if being in this experimental environment is new and interesting, or the task novel and curious enough to pique their interest, the interest stimulation

(which influences dopamine production) might cause the regulation of executive functions to be easier for them. In contrast, if the task is very boring and repetitive or the participants just want it done, they will quickly lose interest, dopamine levels will likely fall, and the brain of an individual with ADHD will seek an alternative source of interest and willpower will likely fail.

Another factor that could be involved is the physiological and historical experience of the individual. Due to the executive function challenges of people with ADHD, demanding cognitive challenges that rely on executive functions actually *are* more difficult for them, especially in areas of low interest. This could therefore lead to a general reduction of a sense of self-efficacy that are not simply "beliefs" but are actually based in physiological realities for them: it actually is harder for them. This is further reinforced and confirmed by their past experiences. Teachers and family members may have criticized them for willpower failures, not understanding that self-regulation and ADHD traits are situationally variable. This could compound the fact that they believe they "don't try hard enough," cause them to give up sooner, and affect their outcomes in the experiment.

Finally, in their study, Job et al. (2010) found a curious result. In one condition, participants who were led to the mindset that self-control was an unlimited resource, actually did worse on the non-depleting task than they did on the depleting task, and the experimenters put forth the possibility that boredom may have caused the depletion. This finding aligns with the role of interest and subsequent situational variability view. For an individual with ADHD, boredom increases the effect of a challenged attention and regulation system. Executive functions would be more impaired, less dopamine would be available, ADHD traits would be more prevalent, and regulatory behavior would fail sooner.

Thus, while mindset clearly is involved, it is not as simple as "think your way to

willpower." Even the researchers admit that there are physiological processes involved in willpower failures. Other factors like interest, executive function, dopamine, and personal experience all have roles to play in the capability of individuals with ADHD to persevere on tasks, and, potentially, the larger (non-ADHD) population too, although to a lesser extent

Vitality and Autonomous Self-Regulation

Self Determination Theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2008) is a potentially complementary theory of motivation and explanation of the ego depletion effect. SDT posits that humans have basic needs for relatedness (to care, be cared for, and to be connected), competence (to build mastery and have a positive effect on their environment), and autonomy (the ability to choose based on an alignment with their wants and desires). In addition, the experience of autonomy is related to the experience of vitality, which is classically defined as having "physical and mental energy. When vital, people experience a sense of enthusiasm, aliveness, and energy available to the self" (Ryan & Deci, 2008, p. 703). Of particular importance here is that they identify two types of regulation: autonomous and controlled. When we must regulate our behavior based on external requirements, we are required to override our personal response. This controlled regulation is therefore experienced as effortful and depleting. In contrast, when regulation is based on self-determined factors that are meaningful and important to the individual, the effort that is expended is experienced as less depleting, is related to increased vitality and, though the activity may require effort, can be experienced as energizing (Deci & Ryan, 2000; Martela, DeHaan, & Ryan, 2016; Ryan & Deci, 2008).

Some ego depletion research has lent support to the mitigating effects of autonomous self-regulation. Muraven (2008) studied 82 undergraduates (57 men and 25 women) in a study of self-control. Subjects were given the choice of whether or not to eat the cookies but were

encouraged to be in the “no cookie eating group.” Participants were then left alone and allowed to make their choice, after which they were then given a questionnaire to explain their choice that included both autonomous and controlled regulation answers. Those who resisted eating cookies for more autonomous reasons experienced less ego depletion on a follow up task than those who resisted because of external reasons. Similar results in other research found that supporting autonomy in actions involving willpower led to better self-control results with subjective vitality found to be a mediator (Muraven, Gagné, & Rosman, 2008). They proposed that the feeling that autonomy was supported, led to an increase in vitality which, in turn, was less depleting of self-control strength and explained the superior regulation results.

It is important to note that while there is a psychological component to subjective vitality, Ryan and Frederick (1997) note that it is also affected by biological factors. This admission leaves the door open to an alignment with the theory that brain glucose levels are involved in ego depletion. Kazén et al. (2015) in a study of 57 undergraduates (34 women) manipulated instructions as either self-motivating (autonomous self-regulation) or self-controlling (controlled regulation) to participants before a cognitively demanding task. They then administered a different effortful task and measured both glucose levels as well as performance. They found that for participants in the self-control condition, blood glucose levels and performance dropped. However, for participants in the self-motivating condition, blood glucose actually rose and they performed better than the self-control condition. In addition, the self-motivating condition correlated with less effort, more ease and was moderated by fun, all lending further support to the possible rejuvenating effect of autonomous self-regulation.

Discussion - ADHD and autonomous self-regulation. Autonomous self-regulation theory proposes that self-aligned and self-selected actions increase vitality and are less depleting

than controlled or externally directed actions (Ryan & Deci, 2008). This model provides a clear parallel to the unique needs of the brain with ADHD. Autonomy of choice, by definition, is interesting to the individual, aligned with a clear intention, and hence, stimulating to the brain. That goal-aligned interest would stimulate dopamine, mitigate executive function challenges for that situation, and make willpower potentially irrelevant because of the alignment of interest and intention. The increase in vitality energy in autonomous choices and situations (Martela et al., 2016; Ryan & Deci, 2008) would further add to the energy of interest.

Further definition and study of controlled regulation would be valuable here. For people with ADHD, structures and systems are often put in place to help compensate for other challenges. For example, using the reminder function on a smart phone can help compensate or "scaffold" support for memory issues. Having another person in the room while they are doing work can mitigate against distractibility. Articulating what actually constitutes a controlled regulation and what does not is valuable information for planning appropriate support structures for people with and without ADHD alike.

The Shifting Priorities Model

Inzlicht, Schmeichel, and Macrae (2014) criticize the strength model of self-regulation on three separate accounts. First, while they acknowledge that glucose has some role to play in self-control, given findings that a glucose mouth rinse has a similar effect to actually consuming glucose (Hagger & Chatzisarantis, 2012; Molden et al., 2012), how glucose is involved is unclear. Second, a number of studies find that there are other variables that seem to counteract the ego-depletion effect when one would be expected to be seen, thereby bringing a limited resource theory into question (for example see: Alberts et al., 2011; Burnette, Babij, Oddo, & Knouse, 2020; Jón et al., 2017; Kazén et al., 2015; Kelly et al., 2017; Muraven & Slessareva,

2003). Third, they posit that, from an evolutionary perspective, it makes no sense that natural selection would favor self-control failure based on a limited resource rather than based on motivational priorities. Thus, their model articulates proximate and ultimate causes for ego depletion (Francis & Inzlicht, 2016; Inzlicht et al., 2014).

Francis and Inzlicht (2016) and Inzlicht et al. (2014) propose that effort fatigue should have an evolutionarily advantageous purpose. In nature, both humans and animals seek a natural balance between present needs and future oriented pursuits, what they term respectively exploitation (of current resources) and exploration (seeking future resources). If animals or humans focus too much on either one, it becomes disadvantageous for them. For example, if you are constantly seeking for the future, your day-to-day survival needs would suffer. If, instead, you focus solely on current resources without consideration of future needs, you will use up resources and, once exhausted, potentially threaten your survival as well. Thus, a balance between immediate rewards and future rewards are optimally advantageous. Translating this to modern times, they propose that there is a natural balance between labor and leisure. Thus, willpower failure is not the result of depleting a limited resource but rather, in part, the natural balance between immediate enjoyment (exploitation) and gratification delay (exploration).

In addition, the subjective feeling of effort on any given task is determined by both executive functions, such as inhibiting impulses, and the level of enjoyment experienced. Thus, the proximate cause of behaviors are governed by a personally subjective dynamic between *have to* and *want to* goals, and perceptions of levels of effort (Inzlicht et al., 2014). *Have to* actions, being externally controlled, increase perceived effort and the task becomes less rewarding. This causes a motivational shift toward the more pleasant *want to* actions; away from a future orientation where current desires are suppressed, to a present orientation of immediate

gratification. However, Baumeister and Vohs (2016) question "how it can be adaptive to shirk necessary tasks" (p. 98) and propose that it, instead, could be seen as dangerous from an evolutionary perspective.

Discussion - the shifting priorities model. Inzlicht et al. (2014) have put forth the proposal that willpower failure is the result of a shift in priorities between future oriented self-control behaviors which are experienced as subjectively effortful, and a desire for immediate rewards. They propose that too much future orientation is dangerous because it neglects immediate needs, while too much attention to the immediate needs uses up current environmental resources needed for survival and is dangerous for the long term. They propose that we have adapted a homeostatic balance between these two extremes. When we suppress our desire for immediate reward, we experience the feeling of subjective effort. When this subjective experience goes on for too long, we experience a motivational shift toward leisure, pleasure and immediate reward as a natural balance. They also cite Clarkson, Hirt, Jia, and Alexander (2010) where participants who believed an easy task would be depleting led to impaired performance on that task, to emphasize that it is the perceived exertion that drives depletion (Francis & Inzlicht, 2016). There are some limitations with this approach

First, the model seems to hold an assumption that this homeostatic balance is a unified drive born of natural selection within individuals. While this may be true for a portion of the population, it ignores an explanation of individual differences. Research by Salmon et al. (2016) suggests that people have differing levels of resistance to a depletion effect; some people deplete after a little effort while others can sustain much more. Why would there be such variability if this drive is so unified? Natural selection may have selected for variability within the group, particularly when one considers the variation of ADHD and non-ADHD individuals. If we

assume that ADHD with its impulsivity and interest seeking wiring exist because it has a natural selection advantage, impulsivity and seeking interest must have a species advantage. I propose different people have different predispositions to self-control and willpower. People with ADHD impulsivity and a lower tolerance for forced regulation may have been more likely to be the explorers, inventers, and the creatives. Seeking novel environments and experiences, they may have been more likely to find new sources of food. So, rather than seeing this homeostatic quest solely within the individual, I propose that unique predispositions were selected for as a group and that we all fall somewhere on the continuum. Thus, understanding our individual predispositions can allow us to work within our strengths. Some of us may need more variety, while others can maintain singular effort for a more extended period of time. Some of us may have a higher tolerance for boring tasks and can muscle through, while others may need to compensate for the boredom by doing the task in an interesting way. A consideration of the individual's level of need for interest and the interest level inherent in a given situation can govern how the situation is approached. I propose that this is a better view of the evolutionary effect on ego depletion.

Second, when they cite Clarkson et al. (2010) to drive home that it is the subjective experience of effort that drives depletion, they ignore a contrary finding. In that study, the group that was given a depleting task and then told that that task would deplete them, actually performed well on the follow up tasks. If it were strictly the subjective experience of effort that was driving the results, in this case doing something depleting and being told would be depleting, one would expect to see depletion. Here, an ADHD lens may shed some light. If we ask what is the interest stimulation that may be driving the better performance, you could hypothesize that this group saw this scenario as a challenge. Seeing it as a challenge could have

potentially elevated the level of interest which would boost levels of dopamine and engage the motivation system (Volkow et al., 2009; Volkow et al., 2011; Volkow et al., 2017) resulting in a better outcome. So, while there is an argument that in some cases, perceived exertion can have an effect, without an assessment of interest level, the findings are inconclusive.

Finally, if too much willpower use causes a shift in motivation toward proximate rewards and leisure, what about the opposite effect when there is excessive focus on proximate leisure? Francis and Inzlicht (2016) offer some references to monkeys and bears that will push a lever for food when they do not have to, and they propose that sometimes humans and animals will choose to engage in effortful tasks when there is an excess of immediate gratification. They propose "The pursuit of a balance between exploitation and exploration results in novelty seeking and exploration, even though it requires extra work" (p. 388). In other words, when you have been engaging in too much proximate leisure, you will finally put down the video game and get off the couch. From an 'interest seeking brain' perspective, I would propose that what they are actually describing here is the flow between interest and boredom. From an ADHD perspective, when what is in front of us loses its novelty, the individual with ADHD becomes bored and will seek out other stimulation. Describing the yin and the yang of motivation and willpower from levels of interest would give researchers something more concrete to test than shifting priorities.

Conclusion and Future Directions

In the discussion sections, I have attempted to lay out a number of possible areas that should be included in future research. I have also attempted to show that the unique need for higher levels of interest in the brains of individuals with ADHD is the positive intention of a brain that is challenged by dopamine irregularities and executive function challenges. Thus, the

negative results of willpower failure, when seen through that positive lens and not simply the deficit lens, leads us to an appreciation of the individual differences and unique variations of the human brain, and allows practitioners to craft support structures that build on strengths and what is working, rather than simply relying on a pill to "fix." This focus is critical for people with ADHD, but potentially beneficial for all people who experience willpower failure since the failures are a matter of frequency and degree, not whether they occur or not.

Future research should include inquiries into interest level, situational variability factors, executive function measures, and a measure of alignment with purpose and intention for the experimental tasks. In addition, special attention should be paid to researching ADHD and ego-depletion, specifically, as little research has been done in this area. To date, only one study in a doctoral dissertation from 2006 looked at ego depletion and ADHD. Lubusko (2006) hypothesized that participants with ADHD would experience more ego depletion than non-ADHD participants. 108 university students (54 with reported childhood and current ADHD, and 54 non-ADHD matched peers) were recruited and randomly divided into a depletion (computerized self-control task) or a non-depletion (arithmetic task) condition. Though the researcher expected the ADHD group to show a stronger depletion effect and poorer self-regulation after a follow up handgrip task and gambling task, no depletion effect was found. One of the potential explanations that the researcher put forth as a possible explanation for this lower than expected ego depletion effect was that the situation itself may have affected the outcome. He posited that "working in a novel situation, working on interesting tasks, and having one-on-one attention" (p.113) may have been responsible for the less than expected depletion effect. Obviously, none of these possible explanations were tested, but the insight of the researcher aligns with the premise of this paper, and aligns with clinician recommendations about support

necessary for individuals with ADHD to mitigate willpower failure.

ADHD is a complex brain wiring that is seen by most as a dysfunction and disability that, when left untreated, can have serious physical and psychological health consequences. There are, no doubt, profound weaknesses that require support, and often those weaknesses are mistaken for character flaws by well-meaning others. However, this dysfunction-focused perspective is only half of the viewpoint. Viewed differently, with a lens that seeks to understand the needs of this unique nervous system, we can begin to work within its strengths so that this population can flourish. Furthermore, studying this unique brain wiring in challenging situations like willpower failure and ego depletion, offers a unique perspective that can benefit all.

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