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The Role of Executive Function in Impulsive Consumer Purchasing Behavior

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by

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ABSTRACT

This study was designed to investigate the relationships between executive function, impulsivity, and personality within consumer behavior. In particular, this study tested whether executive function influences consumer decision making. In order to answer that question, three datasets were analyzed. In Study 1A, a dataset was collected of self-report measures (N=6,122) and was analyzed to investigate the role of executive function with impulsiveness and personality on consumer behavior. In this dataset, a self-report measure for executive function (EFI) was employed. In Study 1B., a second data set (N=6,000) of self-report measures was collected and analyzed to validate the results from the first data set. In Study 2, behavioral measures of inhibitory control, cognitive flexibility, and working memory capacity were subsequently analyzed to identify relations with consumer behavior. Additionally, a correlational analysis was conducted on the self-report measure Executive Function Index (EFI), with cognitive measures previously determined to measure cognitive flexibility, working memory, and executive attention in order to identify variance overlap with executive functioning. Results for these studies demonstrated that components of executive function—particularly inhibitory control and working memory capacity—are related to impulsive consumer decision making. Further, these data illuminate the relation between a self-report measure of executive function and performance-based assessments. It appears that the Executive Function Index may be more closely related to self-reported personality than to task-based inhibition, working memory, or cognitive flexibility.

INDEX WORDS: Consumer behavior, Executive function, Executive attention, Working memory capacity

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For Grace, Faith, Joe, and Kate.

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1 INTRODUCTION

Why do we purchase products? More specifically, when and why do we buy products or services on impulse rather than as planned purchases? Scholars in the fields of psychology, marketing, and decision sciences have contributed to the consumer behavior literature, enhancing our understanding of the question, "Why do we buy products?" Within this research, impulsive consumer behavior has emerged as one category within the broader realm of consumer decision making. Psychologists have proposed that the cognitive construct of executive function largely accounts for impulsive behavior in general. The literature on executive function and its components is large and growing rapidly, driven by studies of its role in behavioral issues such as: impulsiveness in individuals with attention deficit and hyperactivity disorder (ADHD; Barkley, 1997; Brown, 2009); risk-taking by adolescents (Romer, Betancourt, Broadsky, & Giannetta, 2009; 2011); violence and aggression (Sequin, Bolerice, Harden, Trembley, & Pihl, 1991); and substance use (Giancola & Tarter, 1999; Dolan, Bichara, & Nathan, 2008). However, less research has been published on the relations between the components of executive function and impulsiveness as expressed in consumer behavior.

This study is designed to investigate these relations between executive function, personality, and impulsive consumer behavior. Specifically, this study seeks to identify the relationship between individual differences in components of executive function—set-switching (cognitive flexibility), executive attention (inhibition), and working memory capacity (updating) — with impulsiveness and personality traits (conscientiousness, openness to experience, neuroticism, extroversion, and agreeableness) within impulsive consumer purchasing behavior.

1.1 Background

1.1.1 Consumer behavior

With the rise of the Industrial Revolution, human consumption—specifically a culture of consumption—increased among various groups of people in Europe (Jansson-Boyd, 2010). By the nineteenth century, academics began to identify the impact of material possessions on individuals. James (1890, 1950) discussed how "a man's Self" was the accumulation of "not only his body and psychic powers" but also his "clothes, his house" among relationships and his work; he also claimed, "If they wax and prosper, he feels triumphant. If they dwindle and die away, he feels cast down" (pp. 291-292). The field that subsequently was founded in the mid-20th century on the foundation of James's writings was originally referred to as buyer behavior; but later became known as the psychology of consumer behavior. Consequently, this field seeks to understand the psychology of human consumption.

Consumer behavior can be defined as how individuals or groups choose, use, and discard products, services, experiences, or ideas to satisfy needs or desires (Kuester, 2012). It encompasses behaviors and outcomes, including (but certainly not limited to): management of personal finances, planned or impulsive purchases, information research of products and services, group identification, and risk-taking behaviors. The study of consumer behavior, therefore, is the study of the processes involved when people engage in choosing and purchasing services, products, experiences, or ideas. The investigation of these processes includes not just the moment of exchange, but an entire timeline: pre-purchase planning or non-planning, purchase engagement and decision (exchange), and post-purchase (feelings of remorse/satisfaction, disposal, and/or influence upon others).

During the course of a purchase, an individual must engage in decision making and judgment using either affective influence, habitual or automatic response, or a more controlled, deliberate approach (Solomon, 2015). These decisions—including automatic, habitual or "snap" judgments, or carefully-planned, controlled, rational decisions—ultimately reflect patterns of behavior for consumers. Individual differences exist within consumer groups on what types of purchases require certain types of decisions. In other words, one individual may make a snap decision when purchasing a car because she likes the color red, while another individual requires substantial research and deliberation on horsepower and fuel efficiency to arrive at the same conclusion to purchase. All of these decisions of consumption are informed by an individual's cognitive ability and personality.

Of the types of decisions (affective/emotional, habitual/automatic, or controlled/planned) consumers make, a pattern of impulsive purchasing can emerge. Marketing researchers have published many studies on this type of consumer behavior, typically with the intent to identify and predict impulsive buyers' behavior, thus aiding companies in their marketing strategies. Clover (1950) identified impulse purchase behavior as indistinguishable from unplanned purchases. Applebaum (1951) proposed impulsive purchasing as the outcome of unplanned purchasing plus exposure to an external stimulus. Nesbitt (1959) added to Applebaum's definition of impulsive purchasing by offering the perspective of impulse purchase behavior as "intelligent." He theorized intelligent shoppers took advantage of in-store promotions instead of pre-planning their purchases and, in doing so, maximized their purchasing potential. Stern (1962) differentiated four types of impulsive purchase behavior: Planned, Pure, Reminder, and Suggestion. Within all of these types, exposure to external stimuli was considered an integral part of the impulse purchase experience. Rook (1987) subsequently defined impulsive purchase

behavior as unexpected purchases unplanned before entering a retail outlet, resulting in rapid purchase decision, preceded by a strong urge to possess a product or service, and reflecting the consumer's emotional and cognitive response to a sudden stimulus. Within this definition, Rook and Koch (1985) incorporated five specific elements: (a) feeling a "spontaneous desire to act;" (b) being in a state of "psychological disequilibrium;" (c) feeling "emotional/psychological conflict and struggle;" (d) reduced "cognitive evaluation;" and (e) purchase "without regard for outcome or consequence" (p. 23). Rook argued that his definition encompassed impulsive purchasing as a more "hedonically complex" experience with emotional conflict and more emotional than rational (p. 191).

Piron (1991) added to Rook's definition, considering impulsive purchase as an unplanned purchase induced by exposure to either an external or internal stimulus that was spontaneous or sudden, causing emotional and/or cognitive reactions, and followed by one's "discounting of own responsibility" (p. 513). Piron's addition to the definition by addressing personal responsibility acknowledges the outcome of ongoing consequences to personal finances.

1.1.2 Executive function

Goldstein, Naglieri, Princiotto, and Otero (2014) traced the concept of a control mechanism back to the case of Phinneas Gage in the 1840s, who experienced an accident resulting in damage to his left frontal lobe and subsequent "hyperactivity" and loss of inhibition. James (1890) and other scholars discussed cognitive control, or what may be defined in current terms as executive function: one's choice of attending to multiple stimuli or "taking possession of the mind" to "withdraw[al] from some things in order to deal effectively with others" (p.403). Broadbent (1953) used Cherry's cocktail party effect (1953) as a foundation to develop his early selection model of attention. While not addressing executive function in explicit terms,

Broadbent proposed the existence of an attention filter that allows individuals to select some stimulus inputs over others. In his early-selection model, he suggested humans process information through a sequence of stages, with a filter separating salient information (that which is to be attended to and allowed to move to encoding) from other information to be ignored.

Atkinson and Shiffrin (1968) proposed the need for control processes to allow individuals to attend selectively to stimuli to maintain information in short-term memory storage without decay. Shiffrin and Schneider (1977) introduced the concept of controlled and automatic processing in which repetition allows a task to be performed with fewer cognitive resources. In other words, the task becomes automatic. Automaticity is characterized as uncontrolled, effortless, unintentional, and typically occurring outside of awareness. However, Shiffrin and Schneider found that some tasks required controlled processing, despite repetition. Furthermore, there were individual differences in which tasks and how much repetition was needed for automaticity to occur.

Around the same time, Posner and Snyder (1975), building upon Broadbent's early filter theory of attention, suggested a type of cognitive control that consisted of an executive aspect of the attentional system accountable for directing attention on specific or chosen elements of the environment. Posner suggested three networks of attention: orienting (sensory input), alerting (awareness), and executive control. According to Posner, the executive control resolved conflict. In addition, Posner suggested that cognitive control was necessary for an individual to control thoughts and emotions (Rueda, Posner, & Rothbart, 2004). Posner's Cognitive Control model proposed not only a component of selective attention but also an element of inhibitory control, as he argued cognitive control was also responsible for overriding automatic responses (Posner & Snyder, 1975).

Baddeley (1986) subsequently developed the idea of a central executive system within working memory. His central executive hypothesis proposed an executive feature of cognition that oversaw/controlled the slave systems of working memory (phonological loop, visuospatial sketchpad, and episodic buffer). This system coordinates how information is used by the slave systems by controlling attention designated to tasks engaging information. Baddeley identified the executive as critical to selective attention, activation of long-term memory, and switching of retrieval plans.

Norman and Shallice (1980, 1986) proposed a supervisory system that regulates attention and can override automatic responses. This supervisory system was part of a dual-system model for action selection comprising both bottom-up (contention scheduling) and top-down (supervisory system) processes. The contention-scheduling system is responsible for routine action, and operates according to habits, priming, and similar associative mechanisms. The supervisory system is the overriding system used for novel action. Each action is composed of a hierarchy of schemas leading to the proposed action. In the contention-scheduling system, schemas are activated from environmental triggering, but schemas may also be activated from the supervisory system based on executive constraints and when conscious attention control is necessary. In particular, the supervisory system may bias or override the activation of a schema. Thus, the supervisory system may inhibit activation of schema in routine action and operate as a control system.

In the subsequent years since the work of Posner, Baddeley, and Norman and Shallice's foundational work in executive function theory, many constructs have fallen under the umbrella of executive function, including working memory, attention control, self-monitoring, self-regulation, initiation, decision making, planning actions, monitoring and metacognition, set-

switching, inhibitory control, adaptive behavior, and prospective memory. More recent definitions of executive function emphasize goal-driven behavior. For example, Barkley (2011) defined executive function as "a self-directed set of actions intended to alter a delayed (future) outcome" (p.11), and Dawson and Guare (2010) defined executive function similarly by stating, "Executive skills allow us to organize our behavior over time and override immediate demands in favor of long-term goals" (p.1).

Most theories of executive function, however, continue to reference Shiffrin and Schneider's (1977) original distinction between automatic (i.e., bottom-up, contention scheduled, stimulus driven, routine, or exogenous) and controlled (top-down, goal oriented, non-routine, or endogenous) processing. This framework, known as dual-process theory, suggests executive functioning involves the modulation of the automatic processes by the controlled processes; it is the process engaged to override habit-driven, environmentally induced automatic behavior in favor of novel, adaptive, non-habitual but controlled behavior. Dual-process theories of the mind have been used within many theories in psychology, including attribution theory (Ulemena, Newman & Moskowitz, 1996), theory of personality (Epstein, 1998), and, most applicable to this current study, the theory of self-regulation (Baumeister & Heatherton, 1996).

In addition (and complimentary) to the dual-process framework of executive function, Miyake et al. proposed a model known as the Unity/Diversity Model, consisting of three separate but correlated factors that comprise executive function. Those factors are mental set-shifting (cognitive flexibility), inhibition of pre-potent responses (inhibitory control), and information updating and monitoring (working memory capacity; Miyake et al., 2000). Miyake and Friedman (2012) argue that individual differences within executive functions exhibit the following: (a) both unity and diversity, in that different executive functions can be correlated but separated; (b)

substantially genetically informed; (c) related to different clinical and societal behaviors; and (d) demonstrate some developmental stability (p. 8). Most recently, Miyake and colleagues (2017) have demonstrated evidence that within the Unity/Diversity Model of executive function, inhibitory control may not be a discreet component of executive function, rather, it is more a common executive function, and both working memory capacity and cognitive flexibility are more specific executive function constructs that exist distinctly from the common executive function.

Diamond et al. (2013) have proposed a model of executive function that corresponds to and compliments both the Dual-Process and Unity/Diversity Models. From a developmental perspective, Diamond traces the lifetime progression of the core executive functions: inhibition and cognitive interference control, working memory, and cognitive flexibility. Diamond suggests that inhibitory control involves the ability to control not only attention (control at the level of perception as well as consciously choosing to ignore specific stimuli opposed to our goals) but also interference control (suppressing unwanted thoughts or memories), behavior (self-control in the forms of delay gratification, staying on task, delaying pre-potent responses, and "not acting impulsively"), thoughts, and/or emotions (p.137).

For the present study, Miyake and Diamond's model of the core factors of executive function will be applied; thus, behavioral measures for the experimental study in this project will reflect validated measures of cognitive flexibility (set-shifting), inhibition/cognitive interference control, and working memory capacity (updating/monitoring). Although Miyake and Friedman's model is popular, and Diamond's model is fairly recent, those models are certainly not the only conceptions of the factor structure of this construct. To illustrate this literature, Table 1.1 summarizes some of the other popular theories of executive function.

Table 1.1 Some Influential Models of Executive Function

Theorists	Theory	Components
Luria (1966)		Anticipation, Planning, Execution, Self-Monitoring
Norman & Shallice (1980)	Supervisory Attentional System	Supervisory Attention System is the executive monitoring system that controls contention scheduling and the activation of thought and action schema.
Stuss & Benson (1986)		Initiation, Planning, Sequencing, Organization, Regulation
Daigneault, Braun, & Whitaker (1992)		Six components of pre-frontal or executive functions: planning, execution, self-regulation, maintenance, spatiotemporal segmentation, and sustained mental productivity.
Denkla (1994)	Neuropsychological Approach	Executive function is a set of domain-general control processes that contain future tense aspects and should not be viewed as hierarchically superior but central to cognitive operations. EF is control processes for organization of behavior over time.
Leezak (1995)		Volition (self-awareness and self-monitoring), planning, purposive action, effective performance
Borkowski & Muthukrishna (1992) Borkowski & Burke (1996)	Information Processing	Executive Function, as the most important process within a metacognition system, is comprised of task analysis, planfulness, reflectivity, monitoring, and strategy revision. The three major components of executive function are task analysis, strategy control, and strategy monitoring. A fourth closely linked with strategy selection is strategy revision.
Hayes, Gifford, & Ruckstuhl, Jr. (1996)	Relational Frame Theory	Executive function is the ability to derive, apply, or actually follow verbal rules when they are in conflict with other verbal or nonverbal sources of behavior. Verbal self-regulation is a key component of executive function.
Barkley (1997)	Self-Regulatory Model	EF comprises four main functions: working memory for inhibitory control, control of inner speech, control of emotional response, and reconstitution/behavior analysis. Executive Response is a special case of "attending behavior." Behaviors that alter the likelihood of later events and behaviors.
Miyake & Friedman (2000)	Unity and Diversity theory	Three factors of executive function are updating, shifting, and inhibition.
Sohlberg & Mateer (2001)		Initiation and drive, Response Inhibition (stopping behavior), Task Persistence (maintaining behavior), organization, generative thinking (cognitive flexibility), awareness (monitoring)
Miller & Cohen (2001)		Cognitive control biases sensory signals to promote task appropriate response

Keil & Kaszniak (2002)		Planning, scheduling, strategy use, rule adherence, generation, fluency, initiation, shifting, suppression, concept formation, abstract reasoning
Zelazo & Muller (2002)	Cognitive Complexity and Control	Functional construct; Executive Function can be understood as development of application of rules to problem solving within development of children. The components responsible for ability to problem solve are problem definition, planning, execution, and monitoring abilities.
Pennington (2002)	Neuropsychological	Executive Functions are neurocognitive processes, "top-down" cognitive control, including working memory and executive attention, that facilitate decision making by holding information in working memory and maintaining an appropriate problem-solving set to accomplish a future goal.
Weibe, Espy, & Charak (2008)		Executive function is a unitary, domain-general process in preschool that develops in a sequence of working memory, inhibition and then set-switching.
Banich (2009)	Cascade of Control	Sequential cascade of brain regions to maintain attention sets for goal-directed behavior. Activation of one area depends upon efficiency of the brain area activated prior.
Latzman & Markon (2010)		Three factors from factor analysis of D-KEFS labeled Cognitive Flexibility, Monitoring, and Inhibition, found in adolescent male sample (age 11-16).
Diamond (2013)		The core components of executive function are Inhibition (resisting temptations or acting impulsively) and Interference Control (selective attention and cognitive inhibition), Working Memory, and Cognitive Flexibility (adapting quickly to changing circumstances and creatively thinking outside the box).
Friedman & Miyake (2017)		As an adjustment to the Unity/Diversity Model, Executive Function is comprised of two distinct factors of Updating (WMC) and Shifting (Cognitive Flexibility), with a common EF factor supporting (previously Inhibitory Control) them.

1.1.2.1 Working memory capacity and controlled attention. Miller, Galanter, and Pribram (1960) coined the term "working memory" in *Plan and Structure of Behavior* when discussing the human ability to chunk information using short-term memory while performing planning tasks; however, their use of the term differed from current connotations. Baddeley and Hitch (1973) proposed the theoretical construct of working memory to address phenomena not accounted for by Atkinson and Shiffrin's (1968) Modal Model of memory. Specifically, the Modal Model of memory proposed three stages of memory: sensory memory, short-term

memory, and long-term memory. Atkinson and Shiffrin proposed that these three memory processes are strictly sequential: information must be first acquired through sensory memory and processed in short-term memory in order to be encoded into long-term memory. Baddeley and Hitch (1974) challenged this proposition with the finding that individuals could perform dual tasks simultaneously with minimal performance decrements on either task, suggesting that memory could simultaneously store and manipulate information. Baddeley and Hitch used the term "working memory" to account for memory processes manipulating information in addition to modality-specific short-term storage, defining it as a memory capacity system that "provides temporary storage and manipulation of the information necessary for such complex tasks as language comprehension, learning, and reasoning" (Baddeley, 1992, p. 556). Baddeley subsequently proposed four components of the working memory system: a central executive, phonological loop, visuospatial sketchpad, and the episodic buffer. Most relevant to the present study, the central executive system was believed to be a mental faculty that regulates an individual's thoughts to achieve to task goals and controls recall of information from the "slave systems" of the phonological loop and visuospatial sketchpad (Baddeley, 1986, 1996, 2000).

Cowan (1995, 1999) proposed that rather than existing as a separate structure from long-term memory, working memory works within the same system. In Cowan's view, working memory is simply the subset of long-term memory that is most active at any moment, rather than separate representations within domain-specific storage units as was suggested by Baddeley. These activated representations (which could be theoretically limitless in number, although Cowan consistently reported the limits to be around four or five items) are retrieved or activated, and can be maintained in active, conscious use by strategies (similar to skills suggested by Baddeley within his "slave systems"). Cowan argued that if these strategies are not available or

useful, or if there are environmental stimuli that threaten to compete for cognitive resources, other traces may be activated, and the previously-activated representations become faded and lost. Attention control, according to Cowan, could aid in maintaining access to the activated memory traces, but could hold a limit of four chunks of information.

Of the various tasks attributed to the central executive system, the ability to control lower-level processes that hold information, even during interference or distraction, would be most applicable to this study, and has been identified as one of the more important functions of working memory (Engle, 2002; Kane, Bleckley, Conway, & Engle, 2001; Norman & Shallice, 1986). This function is referred to as either working memory capacity or executive attention (Engel, 2002) and can be understood as "the ability to control attention to maintain information in an active, quickly retrievable state…Working Memory capacity is not directly about memory– it is about using attention to maintain or suppress information" (Engel, 2002, p. 20). Current models of working memory have assumed that the capacity is finite for each individual but that individuals differ in this limit (Barrett, Tugade, & Engel, 2004). These individual differences in working memory capacity have been implicated in performance on many higher-order cognitive abilities, including: reading comprehension (Daneman & Carpenter, 1980); listening comprehension (Daneman & Carpenter, 1983); vocabulary learning (Daneman & Green, 1986); note-taking (Kiewra & Benton, 1988); following directions (Engel, Carullo & Collins, 1991); language acquisition (Baddeley, 2003); language comprehension (King & Just, 1991); reasoning (Barrouillet, 1996); non-verbal problem solving (Logie, Gilhooly, & Wynn, 1994); law enforcement decision making in shooting behavior (Kleider, Parrott, & King, 2009); and memory distortion component in hindsight bias (Calvillo, 2012). These differences have also been found to be a strong predictor for fluid intelligence and executive functioning (Engle et al.,

1999); although most recently, Engle et al. have proposed inhibitory control (executive attention) reflects fluid intelligence and working memory capacity reflects maintenance of information. (Engle et al., 2018).

Barratt, Tugade, and Engle (2004) discussed the role of attention control within the dual-process model and described individual differences in working memory capacity as the source of goal-directed attention. Barratt et al. suggest that working memory capacity is the capability to hold information in an active state while concurrently engaging in planful search of memory and retrieval of pertinent task-relevant information. Therefore, individual differences in working memory capacity can account for the variations in the ability to control or override automatic working memory capacity; controlled attention compliments Posner's theory of cognitive control as an executive attention control, affecting both selective attention and inhibitory control of attention.

Most recently, Engel (2018) has updated his original interpretation of results regarding the relationship between working memory capacity and fluid intelligence. Currently, Engel suggests working memory capacity reflects ability to maintain information, and fluid intelligence reflects the ability to disregard or disengage irrelevant information. Both of these abilities rely heavily on an individual's ability to control attention, and this common dependence on attention control is what led to conflation of working memory capacity and fluid intelligence in previous studies. Engel's updated model is complimentary to Miyake's Unity/Diversity model in that inhibitory control (or as he now refers as common executive function) combined with the other distinct and specific executive functions underlies all complex executive functions (i.e., planning). Both Engel and Miyake are claiming attention control is a common factor in working memory, fluid intelligence and executive function constructs.

1.1.3.1 Working memory capacity and self-regulatory behavior. Within the context of Norman and Shallice's (1986) dual-process model of executive functioning, Barratt et al. (2004) considered contributions of working memory capacity to self-regulation and posited three potential mechanisms through which individual differences in controlled attention may manifest in variations of self-control. First, working memory capacity (attention control) appears to be related to tolerance of ambiguity, such that individuals with lower capacity might be unable to tolerate uncertainty of future events and, thus, may impulsively make a poor decision to end the uncertainty rather than evaluate multiple possible outcomes (pp .21-22). In other words, an individual with lower working memory capacity may, when given multiple options, make a quick (or impulsive) decision without adequately assessing all possible choices because of an inability to tolerate uncertainty. Barratt et al. (2001) speculate that the cognitive load placed upon one by the experience of uncertainty would be costly to an individual with low working memory capacity; in fact, the experience could impede the individual from correctly evaluating the value of future choice. One possible application of this mechanism to consumer behavior may be the ability to evaluate short-term versus long-term reward of purchases. Additionally, set-switching or cognitive flexibility (one of the core EF components proposed by both Miyake and Diamond) could account for the ability (or inability) to evaluate successfully two options (short-term and long-term rewards), as an individual who struggles with flexibility may find switching between two types of rewards difficult.

In the second mechanism discussed by Barratt et al. (2004), working memory capacity assists an individual's ability to resist attentional capture, allowing attention to be sustained via executive, goal-oriented control to the appropriate stimuli rather than to salient distractors. In a consumer-behavior context, these potent distractor stimuli might include advertising strategies

aimed at consumers. Considering most definitions of impulsive consumer behavior indicate a component of exposure to stimuli, this mechanism discussed by Barratt et al. (2004) may account for a large part of self-control issues within impulsive purchasing.

Third, Barratt et al. (2004) suggested that working memory capacity may influence the ability to override or suppress classically-conditioned affective associations that are no longer efficient, optimal, or appropriate—at least at that moment. Marketing professionals certainly recognize the value of classical and operant conditioning in purchasing decisions and so select colors for packaging, images for advertising, celebrities for endorsement, and so forth to increase motivation and build purchasing habits, both of which would require effortful processing to inhibit (DiClemente & Hantula, 2003; De Houwer, Thomas, & Baeyens, 2001; Gorn, 1982; McSweeney & Bierely, 1984).

Several studies have suggested that deficits in the executive control system or central executive system of working memory can at least partially account for the cognitive deficits and self-regulatory problems in highly-impulsive individuals (e.g., Finn, Justus, Mazas, & Steinmetz, 1999; Stanford, Greve, & Gerstle, 1997; Villemarette-Pittman, Stanford, & Greve, 2003). However, the definitions of executive control differed among these studies, as different measures of executive attention/control were used. For example, Finn and collaborators (1999) used the Digit Span Task of the Weschler Adult Intelligence Test, Revised (WAIS-R; Weschler, 1981) and Conditional Associations Task (CAT; Petrides, 1981). In comparison, Stanford and collaborators operationalized executive control as Wisconsin Card Sorting Test (Heaton, Challun, Talley, Kay & Curtis, 1993), design fluency test (Jones, Gottman, & Milner, 1977), and Trail Making Test (Reitan, 1958).

In testing a theory that working memory and conditional associative learning modulate behavioral inhibition, Finn et al. (1999) used a Go/No-Task with a contingency reversal (adapted from Newman & Kosson, 1986). The task involved serial representation on a computer screen (750ms) of eight different two-digit numerical stimuli (four no/go and four go). After the tenth block, contingency reversal took place; i.e., the stimuli that were previously "go" became "no/go" and vice versa. Finn et. al. (1999) demonstrated that individuals with low working memory capacity (digits backward of Digit Span Task) and low conditional associative learning (Conditional Associations Task) exhibited more errors of commission after contingency reversal (a measure of impulsivity) and predicted success of learning to inhibit behavior after contingency reversal. Furthermore, they found that individuals with low WMC were more susceptible to the effects of alcohol on increasing impulsive behavior, as measured with the Go/No-Go task.

In order to parcel specific factors of executive control related to impulsiveness, Witney, Jameson, and Hinson (2004) predicted impulsiveness (as measured by the Barratt Impulsiveness Scale; BIS-11), from various different measures of executive control, including a new measure of memory scanning. The results of their work demonstrated that significant amounts of variance in impulsiveness can be accounted for by individual differences in central executive control. Further, and more important, a global measure for either executive control or impulsiveness may not adequately convey the complicated relation between the two constructs, as the authors found that the subtypes of impulsivity are related to different subtypes or component factors of executive control. The three subtypes or subscales of impulsivity identified within the BIS are the following: Attentional ("I concentrate easily" or "I don't 'pay attention'"), Non-Planning ("I plan trips well ahead of time" or "I act on the spur of the moment"), and Motor ("I am restless in a movie theater" or "I squirm at plays or lectures"). Overall, working memory capacity and

cognitive inhibition (deleting or ignoring irrelevant information) significantly predicted overall impulsiveness. However, higher scores on the attentional impulsiveness subscale were associated with the inability to delete irrelevant or no-longer-relevant information, but attentional impulsiveness was not related to working memory capacity. In addition, non-planning impulsiveness was predicted by working memory capacity but showed no significant relation to inhibition of interference. Finally, higher scores on the motor impulsivity subscale were associated with lower overall capacity and a greater ability to inhibit interference.

Hofmann, Gschwendner, Friese, Wiers, and Schmitt (2008) tested the relation of working memory capacity (using a computation span task) on self-regulatory behavior, operationalized as sexual interest behavior, consumption of tempting food, and expression of anger. Summarizing the previous literature (Carver, 2005; Hofmann, Rauch & Gawronski, 2007; Strack & Deutsch, 2004), Hoffman et al. (2008) argued that self-regulatory behavior was ultimately the product of a conflict between automatic and controlled processing systems. Consequently, they reasoned that individuals with greater working memory capacity should have greater resources to devote to the controlled system, allowing for more successful self-regulatory behavior. The authors demonstrated that the relation between working memory capacity and self-regulatory behavior was more complex than a direct correlation; rather, they argued that working memory capacity moderates the relation between automatic (i.e., temptations, urges, arousal, impulses) and controlled (i.e., goals, implementation intentions, incentive) precursors and behavior, suggesting higher working memory capacity allows for more capacity to hold long-term goals and shield those goals from interference, particularly from automatic processing (i.e., impulses).

Hinson, Jameson, and Witney (2003) suggested a reinterpretation of findings such as these. They argued that the effects of working memory capacity on decision making were

reflective of problems in evaluating reward magnitude and, I propose, perhaps future consequences. In situations where cognitive demands are high, or in which individuals have deficits in working memory capacity, an immediately-available reward may be overvalued relative to a delayed reward because the individual lacks the resources to properly evaluate the displayed reward. Thus, a behavior that appears impulsive (select the smaller-sooner reward rather than the larger-later) may, in fact, be a reasonable decision based on distorted evaluations of reward magnitudes (the immediate reward is overvalued, and/or the delayed reward is undervalued). Referencing the Delay-Discounting (DD) paradigm, Hinson et. al. (2003) suggested that, in situations where either high cognitive load is present or where an individual has deficits in working memory capacity, an immediately-available reward might be overvalued because the individual cannot evaluate a delayed reward properly due to limited available cognitive resources. As working memory capacity is utilized in a large variety of contexts, the impulsive decision strategy may appear as a personality trait, identified by standardized measures of impulsivity like the BIS-11 (Barratt, 1994). Supporting this interpretation, Hinson et. al. (2003) demonstrated that Delay-Discounting performance is related to working memory capacity. When manipulating cognitive load, an increase in load predicted increases in impulsive decisions in delay discounting (choice of immediate reward over delayed reward), and individual differences in BIS-11 and self-report dysexecutive questionnaires were also strongly related to delay-discounting performance.

Reimers, Maylor, Stewart and Chater (2009) reported associations between delay discounting and real-world impulsive behavior. Using single delay-discounting choice and self-report measures of a large sample (N=42,863), Reimers and collaborators reported correlations between smaller-sooner choice in delay discounting and several impulsive behaviors: initial

sexual activity, recent relationship infidelity, smoking, and higher body mass index. Associations between smaller-sooner choice and demographic variables (younger age, lower income, and lower education) were also found. Their results suggest an underlying cognitive reason (like low working memory capacity) for performance on delay discounting carries into real-world decisions and behavior.

1.1.3.2 Measuring executive function. Spinella (2005a) developed an instrument for self-rating of executive function within normal populations, called the Executive Function Index (EFI). The EFI consists of five subscales (five components determined through factor analysis to account for the majority of variance): motivational drive, strategic planning, organization, impulse control, and empathy. It was created as an efficient means to gather data from large samples for testing hypotheses regarding prefrontal systems and behavior as well as to bolster findings with behavioral tests and functional neuroimaging. The EFI was found to correlate with other self-reported executive functioning measures, including the Frontal Systems Behavior Scale (FrSBe), Barratt Impulsiveness Scale (BIS), and the Interpersonal Reactivity Index (IRI; Spinella, 2005). Although the EFI may correlate with other self-report measures (FrSBE, BIS, and IRI) that have been validated, the EFI has not, to this author's knowledge, been tested for correlation with behavioral measures of executive function (Carvallho, Ready, Malloy, Grace, 2103; Fernandez, Duffey, Kramp, 2009; Gillet, Mela, Studer, 2013; Neimeier, Perrin, Holcomb, Nerssessova, & Rolston, 2013; Stanford, Mathias, Dougherty, Lake, Anderson, & Patton, 2009; Siu & Sheck, 2005). However, Spinella (2005) contends that the EFI strongly correlates with other self-report executive function measures that have been validated through either clinical, experimental, or neuroimaging studies. If, as is proposed in this study, aspects of executive function—specifically cognitive flexibility, inhibitory control, and working memory capacity—

affect or moderate an individual's purchasing behavior, it must be confirmed that the EFI successfully measures those aspects. To implement the EFI successfully as a measure in a larger survey for modeling consumer behavior, a study should demonstrate and validate which behavioral measures of executive function are accounted for with the EFI.

Since the development of the EFI, the measure has been used in at least three studies. O'Wain and Spinella (2007) found consistent positive correlations between moral attitudes and all subscales within the EFI, independent of demographics, as well as small positive correlations between traditional religious beliefs, empathy, and impulse control. In addition, measures of gratitude and satisfaction were found to be positively correlated with EFI results, while impulse control and forgiveness were negatively correlated within college students (Miley & Spinella, 2006). More recently, Rabin, Fogel and Nutter-Upham (2010) found the EFI significantly predicted, in addition to age and lower conscientiousness, academic procrastination within college students.

1.1.3 Personality

1.1.3.1 Measures of impulsivity: Eysenck Personality Inventory and Questionnaire.

References to impulsivity within individuals can be first attributed to Plato, who wrote, "Quick intelligence, memory, sagacity, cleverness, and similar qualities, do not often grow together, and ...persons who possess them and are at the same time high-spirited and magnanimous are not so constituted by nature as to live in an orderly and peaceful and settled manner; they are driven any way by their impulses, and all solid principle goes out of them" (Plato, c. 503, p.). Hippocrates (ca. 460 BC-370 BC) discussed impulsivity as a phenomenon of temperament, and Galen (AD

129-ca. AD 200) followed within his theory of personality based on four bodily fluids. Impulsive nature was considered an aspect of the Choleric personality type.

It was Eysenck's (1947) theory that first introduced the construct of impulsiveness to modern psychology within the individual differences framework. In the Eysenck Personality Inventory (EPI), Eysenck first proposed the construct of impulsivity as one trait (or theoretical construct comprising statistically-related habitual responses) of several that explained extraversion (Moeller, 2012). Impulsivity comprised of four habits, the first being "impulsivity narrow," which is similar to motor impulsiveness (Stanford & Patton, 2012) and can be defined as responding rapidly without adequate evaluation of the situational context or outcomes (Hamilton et. al., 2015). Eysenck identified three additional habits: non-planning (acting without prior planning), liveliness (motor impulsivity), and risk-taking. However, when psychoticism was included as a personality trait in the Eysenck Personality Questionnaire (EPQ; 1975), the factor "impulsivity narrow" loaded on psychoticism rather than extroversion, while the other three (non-planning, liveliness, and risk-taking) loaded on extroversion (Action, 2003; Whiteside & Lynam, 2001). Thus, Eysenck moved the term impulsiveness to psychoticism and organized the other factors under "venturesomeness" within extroversion. This movement of impulsivity as a component of psychoticism rather than extroversion reflected a difference in approach from individual differences to more clinical perspectives, specifically suggesting impulsiveness as dysfunctional (Moeller, 2012).

1.1.3.2 Measures of impulsivity: Barratt Impulsivity Scale. Barratt (1959) made a significant contribution to the study of impulsiveness when he created a measure of impulsiveness known as the Barratt Impulsiveness Scale (BIS). Barratt hypothesized that the two constructs of anxiety and impulsiveness were orthogonal and created the first version of the BIS

with a goal of eliminating items that correlated with measures of anxiety (Stanford et al., 2009). In later versions of the BIS (Patton & Stanford, 1995; Stanford et al., 2009; Steinberg, Sharp, Stanford, & Tharp, 2013), Barratt suggested impulsivity as a multidimensional construct defined as the following: "a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others" (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001, p. 1784).

Over 40 years, Barratt created and refined the Barratt Impulsiveness Scale to the current eleventh version (BIS-11), which has become the most widely-administered self-report measure of impulsiveness in both research and clinical settings (Stanford et al., 2009). The current version contains three subscales: non-planning impulsivity, attentional impulsivity, and motor impulsivity. This version has been cited over 3,700 times as of 2016. Within these many citations, the BIS-11 has been used to identify high levels of impulsiveness in adults related to cocaine dependency (Lane, Moeller, Steinberg, Buzby, & Kosten, 2007) and Ecstasy abuse (Bond, Verheyden, Wingrove, & Curran, 2004). Studies have identified a relationship between mood disorders and high scores on the BIS-11 (Peluso, Hatch, Glahn, Monkul, Sanches, & Najt, 2007). High levels of impulsiveness on the BIS-11 have also been found for individuals diagnosed with ADHD (Malloy-Diniz, Fuentes, Leite, Correa, & Bechara, 2007) as well as for pathological gamblers (Rodriguez-Jimenez, Jimenez-Arriero, Ponce, Monsor, & Jimenez, 2006), and has been correlated with tobacco use (Spinella, 2002b). In addition, BIS-11 scores have been related to right frontal white matter structure in schizophrenic patients (Hoptman, Volavka, Johnson, Weiss, Bilder, & Lim, 2002).

More specific to the topic of the present study, the BIS-11 has contributed significantly to the individual differences perspective on impulsive behavior. The three subtraits of the current

BIS-11 are defined as follows: motor impulsiveness is acting without thinking, non-planning impulsiveness involves a lack of forethought, and attentional impulsiveness is an inability to focus attention or to concentrate (Barratt, 1985). Within normal populations, high levels of impulsiveness measured on the BIS-11 have been associated with reduced behavioral inhibition (Potts, George, Martin, & Barratt, 2005) and increased sensitivity to reward (Martin & Potts, 2004). In addition, Levine, Waite, and Bowman (2007) found BIS-11 scores to be significantly correlated with academic distractibility.

Coutlee, Politzer, Hoyle, and Huettel (2014) updated the BIS-11 by using factor analysis to eliminate 17 items of the BIS-11 that measured impulsiveness poorly and that did not reflect behaviors applicable to modern culture. The updated version, Abbreviated Impulsiveness Scale (ABIS), was found to be efficient and consistent at measuring aspects of impulsiveness with just 13 items, while maintaining the three subscales refined in BIS-11 (attentional, motor, and nonplanning). In additional testing by Coutlee et al. (2014), the ABIS was successful at predicting alcohol consumption.

1.1.3.3 Measures of impulsivity: Cognitive tasks. Halperin, Newcorn, Sharma, Healey, Wolf, and Pascualvaca (1990) argued that differences in performance (specifically, commission errors) on a continuous performance task (CPT) to measure vigilance between diagnosed ADHD children and control could aid in understanding the role of impulsiveness in ADHD populations. Studies have subsequently confirmed the pattern, with more commission errors in CPT among adults with substance abuse (Moeller et. al., 2005), adults with bipolar disorder (Swann, Pazzaglia, Nicholls, Dougherty, & Moeller; 2003), and children with conduct disorders

(Dougherty, Marsh, & Mathias, 2002)—in each case, clinical groups known to exhibit impulsive behavior.

Logan, Schachar, and Tannock (1997) proposed the behavioral measure of a Go/Stop task as means to identify and define impulsivity, arguing that impulsive individuals would have difficulties inhibiting prepotent responses. Subsequently, Pliszka, Borcherding, Spratley, Leon, and Irick (1997) demonstrated impaired performance on Go/Stop task in children diagnosed with ADHD, a population known to exhibit impulsivity. In more recent years, a variation of Go/Stop task, known as Go/No-Go task, has been used as a behavioral measure of impulsivity (Helmers, Young, & Pihl, 1995) and assesses the ability of an individual to inhibit responding to a stimulus previously associated with either a reward or punishment. Iaboni, Douglas, and Baker (1995) found children diagnosed with ADHD not only to make more errors of commission, but also more errors of omission on trials of stimuli previously paired with reward. While investigating the relationship between executive control function and interpersonal aggressive behavior, Hoaken, Shaughnessy, and Pihl (2003) used a Go/No-Go discrimination task to measure impulsiveness in individuals. They concluded that individuals with low executive control were more likely to show higher levels of impulsivity (as measured by errors of commission in Go/No-Go) and were more aggressive, as measured by Taylor Aggression Paradigm (TAP; Taylor, 1967).

1.1.3.4 Impulsivity and executive function. Chesung, Mitsis, and Halperin (2004) demonstrated BIS-11 scores to be associated with cognitive flexibility and intelligence, as measured by the Wisconsin Card Sort Test and WAIS-11. That same year, Witney, Jameson, and Hinson (2004) reported that subtypes of impulsivity were related to the executive control of working memory. The ability to control attention has also been identified as an important factor

in an individual's ability to delay gratification (Peake, Hebl, & Mischel, 2002; Rodriquez, Mischel, & Shoda, 1989), and, as described in the section above on working memory capacity, low ability in executive attention is associated with a larger impact of impulsiveness on self-regulatory behavior (Hofmann et al., 2008).

In an effort to infer the neurobehavioral correlates of impulsivity, Spinella (2004) tested relationships between impulsivity (BIS-11) and behavioral measures that have been previously associated with prefrontal function (e.g., Go/No-Go, antisaccade, and delayed alternation). The results indicated significant correlations between Go/No-Go and antisaccade performance with impulsivity (BIS-11) and a negative correlation between delayed alternation DAL (correct responses) and impulsiveness. Spinella argued that because the behavioral measures used in this study have previously demonstrated sensitivity to prefrontal function, these findings suggest a role of the prefrontal cortex and associated subcortical structures in impulsivity, thus offering additional validation of the BIS-11.

As discussed earlier, Spinella (2005) also used the EFI subscales to identify specific aspects of executive function related to impulsiveness. He found that the Strategic Planning Subscale significantly correlated (negatively) with the BIS-11 Non-planning Impulsiveness subscale. Furthermore, EFI's Impulse Control subscale, which reflects self-inhibition, negatively correlated with the BIS-11 Motor Impulsiveness subscale.

1.1.3.5 Big-five personality model. The Five-Factor Model of personality is arguably the most comprehensive personality trait model currently used in psychological research (MacRae & Costa, 1987). Goldberg (1993) recounted the history of development of the Five-Factor Model, starting with Galton's (1884) "lexicon hypothesis," leading to the development of the Thurstone Temperament Schedule (Thurstone, 1953), which identified seven factors of personality. Tupes

and Christal (1958, 1961) analyzed results from studies using Cattell's (1943) 35 bipolar variables and identified five factors. They are credited with first introducing what is now known as the "Big 5" model of personality. As described by Goldberg (1993), these five broad factors should be viewed in a hierarchical model in which hundreds of personality traits are organized under the five domains. Factor One (Extraversion/Introversion) is characterized by talkativeness, assertiveness, or silence, passivity, and reserve. Factor Two (Neuroticism/Emotional Stability) includes traits of moodiness, anxiety, impulsiveness, and vulnerability. Factor Three (Openness to Experience) contrasts traits of imagination, intellectual curiosity, and creativity with traits of shallowness and imperceptiveness. Factor Four (Conscientiousness) incorporates traits of orderliness, reliability, and deliberateness. Factor Five (Agreeableness) contrasts traits of trust, kindness, straightforwardness, and compliance with hostility, selfishness, and distrust. (Goldberg, 1993).

The Big-5 Personality model has been used to demonstrate relations between personality traits and various behaviors. Most relevant to the present study, Pirog and Roberts (2007), using the Meta-theoretic Model of Motivation (3M) Framework (Mowen, 2000), identified relationships between personality traits of neuroticism (emotional instability), introversion, conscientiousness, materialism, and need for arousal with credit card misuse in college students. Interestingly, all of the relationships were mediated by impulsiveness, with the relationship of materialism and need for arousal predicting credit card misuse fully mediated by impulsiveness (Pirog & Roberts, 2007).

In an effort to gain understanding of the construct of impulsivity, Whiteside and Lynam (2001) used factor analysis on the five-factor model and four self-report measures of impulsiveness (BIS-11, Dickman's Dysfunctional and Functional Scale, EASI-111, and I-7

Impulsiveness Questionnaire). The authors identified four facets of impulsivity that "are not considered variations of impulsivity but rather discrete psychological processes that lead to impulsive-like behavior" (Whiteside & Lynam, 2001, p. 685). The four facets—urgency, (lack of) premeditation, (lack of) perseverance, and sensation-seeking—showed differing relationships with the five factors of personality. Whiteside and Lynam argued that these four facets are, in fact, separate features of personality that have been mistakenly blended under the larger "umbrella term of impulsivity" (Whiteside & Lynam, 2001, p. 684).

2 STUDY 1

2.1 Study Purpose

The purpose for this study is to answer the following questions: First, what is the relation between personality, impulsive consumer behavior, and executive function, as measured by self-report? Second, what is the relation between personality traits, impulsive consumer behavior, and executive function, as measured by standard cognitive assessments? Finally, what is the relation between self-reported executive function and standard cognitive assessments of executive function? To answer these questions, Study 1 consisted of two large, complementary surveys with self-report measures (Study 1A and 1B) of consumer behavior, and Study 2 utilized survey methodology with both self-report and behavioral measures, as well as a purchasing task.

2.2 Study 1, Part A

2.2.1 Methods

Participants (N=6,122) were recruited to complete an online survey administered through Survey Sampling, Inc. (SSI), selected from their existing panel of 4.1 million adult residents in the United States. Recruitment was conducted by SSI sending an email to their existing panel with an invitation to participate. All members of their panel were given said opportunity and allowed to refuse if wanted. SSI compensated participants in a manner commensurate with all other surveys available to their existing panel and informed subjects in advance that participation was voluntary and could be discontinued at any point within the survey with no penalty. The survey was administered to the general population of the SSI panel, with no limitations placed on screens, with the exception of a minimum age requirement of 18 years old. All participants completed the survey anonymously and were informed in advance that any answers would be reported in aggregate with other respondents. As part of the contract with SSI, personally-

identifiable information was not and will not be released to the investigator of this study. The demographics of the SSI panel consist of the following: 50% females, 49% males, and 1% transgender, and broad ranges in age (ages 18 to 94 years), education levels (less than high school graduate to doctoral level), and socio-economic status. Ethnicity/race information was not reported within this dataset, but the SSI national sample is described as representative of the population. Approval to analyze these datasets was obtained by Georgia State University Institutional Review Board, which ensures the ethical treatment of human subjects.

2.2.2 Apparatus, Measures and Procedure

All surveys were administered via SSI. An email invitation was sent to existing panel members inviting them to participate in a survey. Survey questions were administered via panel members' personal computer, electronic tablet, or mobile device. After obtaining demographic information, including age, gender, and education level, the following tests self-report measures were administered in the same order:

2.2.2.1 Executive function. As discussed in Chapter 1, the Executive Function Index is a self-report questionnaire that purports to measure Executive Function on five subscales: Motivational Drive, Strategic Planning, Organization, Impulse Control, and Empathy. The questionnaire contains 27 items that load on the five subscales. Items are rated on a 5-point Likert scale. Items are listed in Appendix A. As of the writing of his study, reliability and internal consistency estimates have not been published.

2.2.2.2 Credit card misuse. Credit card misuse was measured using a 12-item, five-point Likert scale developed by Roberts and Jones (2001). Individuals with higher scale scores could be viewed as being less responsible in the use of their credit cards. The scale exhibited good internal consistency (a = .78) in a previous study (Omar, Sainz, Rahim, Che Wel, & Shah,

2014). A list of scale items is provided in Appendix B.

2.2.2.3 Impulsiveness. The Brief Barratt Impulsiveness Scale (BIS-8) is an 8-item self-report instrument designed to assess the construct of impulsiveness (Stanford et al., 2009). The BIS-8 version utilized in this study identifies first-order factors of attention, motor, self-control, cognitive complexity, perseverance, and cognitive instability. Second-order factors of attention impulsivity, motor impulsivity, and non-planning are additionally identified. Internal validity for the total BIS-8 is .83 (Stanford et al, 2009). A list of items is provided in Appendix C.

2.2.2.4 Five-factor personality measure. The Ten-Item Personality Inventory (TIPI) was used to gain a measure of the Big Five personality dimensions. This instrument was designed to offer a brief version of the larger Big Five Index with each item representing one pole of the Five-Factor Model dimensions. Mean test-retest reliability for the overall measure is .80, with each factor test-retest reliability as the following: Extraversion .82, Openness to Experience .80, Agreeableness .76, Conscientiousness .76, and Emotional Stability .81 (Gosling, Rentfrow, & Swann Jr., 2003). Items are listed in Appendix D.

2.2.2.5 Spending and value seeking. Nine items were asked in a previous survey designed for consumer research (N=6,037) to identify types of consumer behavior. An EFA was performed to identify factors of consumer behavior. Internal consistency for this measure was considered good (a=.88). A principal components exploratory factor analysis was performed to identify factors of consumer behavior. Promax rotation was used, and no limitation of number of factors was placed. Two factors emerged, which were titled Spending (S) and Value Seeking (VS). These two factors accounted for 76.83% of the total variability (spending, 32.38%; value seeking, 44.45%). These questions and their factor loadings were the following:

- I frequently search for values and coupons (.78 VS);

- I never pay for anything full price (.71 VS);
- Researching for lower prices and ways to save money is something I do frequently (.79 VS);
- I typically wait for a sale to purchase something (.78 VS);
- I don't spend money unless I feel I am getting a really good deal (.65 VS);
- I buy things I don't really need (-.81S);
- I spend more money than I can afford (-.82 S);
- If I want something, I buy it whether I can afford it or not (-.75 S);
- I don't really consider my budget when I really want to buy something (-.86 S).

2.3 Results

2.3.1 Measure Assessments

2.3.1.1 Impulsivity. A principal components exploratory factor analysis was used to identify factor loadings and structure for the eight items in the Brief Barratt Impulsivity Scale used in these studies. Promax rotation was used, as items were assumed, from previous theory and knowledge of the scale, to be correlated. No limitation on the number of factors were set. Two factors were identified and subsequently titled Impulse Action (40.97%) and Impulse Plan (30.87%), and together accounted for 71.83% total variance. Four items loaded for each factor as follows:

- I plan tasks carefully (.82, IP);
- I do things without thinking (.88, IA);
- I don't "pay attention" (.84, IA);
- I am self-controlled (.81, IP);
- I concentrate easily (.84, IP);

- I am a careful thinker (.864, IP);
- I say things without thinking (.8, IA);
- I act on the spur of the moment (.84, IA).

2.3.1.2 Preliminary and bivariate analyses. Descriptive statistics were calculated for all the variables. A correlational analysis (Appendix E) was generated for age, all subscale measures of the EFI (MD, SP, IC, EM, ORG), credit card misuse, value seeking, and spending behavior. Age was moderately correlated with subscales of the Executive Function Index (impulse control, r = -.44; organization, r = -.41) and credit-card misuse (r = .41). Consequently, age was controlled for as a covariate in subsequent analyses. Group comparisons between gender groups on all measures of EFI (subscales and total EFI) and on measures of consumer behavior indicated no significant differences ($p > .10$), so gender was not controlled for or otherwise considered in the subsequent analyses.

After confirmation of normality of distribution of the variables, zero-order correlational analysis (Appendix E) was used to identify relations between the variables of the executive function index (EFI), the five-factor personality inventory (TIPI), impulsiveness, credit-card misuse, value-seeking, and spending. All of the variables were found to correlate significantly with each other, but this result was expected, given the large sample used. Some correlations were moderate to strong: EFI strategic planning with credit card misuse $r(6122) = .53$, $p < .001$; EFI impulse control with credit card misuse, $r(6122) = .54$, $p<.001$; EFI organization with credit card misuse, $r(6122) = .51$, $p < .001$; EFI organization with Impulse Action, $r(6211)=.57$, $p < .001$; EFI Impulse Control with Impulse Action, $r(6211)=.57$, $p <. 001$; and EFI organization

with impulsive consumer behavior, $r(6211)=.53$, $p < .001$. All additional correlations were weak (between -.4 and .4) at best, even though most were statistically significant.

Clearly, there are many interesting ways that these data could be analyzed further. However, the focus of the present project was on relations to consumer behavior, and thus those are the questions that will be addressed here. In addition to examining the component measures, an overall composite score for impulsive consumer behavior was created by first reverse-scoring the value-seeking items, and then averaging the overall (reversed) score for value seeking with the total scores for spending and credit card misuse measures. Consequently, higher scores on the composite consumer behavior score reflects more spending and credit card misuse, together with less value-seeking. Extreme groups for the composite consumer behavior measure were identified as high, average, and low, using approximately top 10% as high and approximately bottom 10% as low, with the remaining 80% as average. For the Impulsive Consumer Behavior measure, approximately 10% of participants were considered to have High Impulsive Consumer Behavior (N=616; range 4.86 to 7). Approximately 10% of participants were considered to have Low Impulsive Consumer Behavior (N=593; range 1 to 2.36), and the remaining 80% were considered to have average Impulsive Consumer Behavior. The large sample size allowed for adequate group sizes to focus this extreme-groups comparison on the top and bottom 10% of scores. In the two extreme groups, ages were evenly distributed in both groups. The Low Impulsive Consumer group was composed of 56% male, 43% female, 1% transgender; mean age of 46.63. The High Impulsive Consumer group was composed of 59% male, 41% female, 1% transgender; mean age of 33.64. To adjust for multiple comparisons, all subsequent analyses were only considered significant if a *p*-value measured less than .001. In addition, in all subsequent analyses within this study, age is identified and controlled for as a covariate.

A series of one-way ANCOVAs were performed to compare the means of all subscales of the EFI between high and low groups of impulsive consumer behavior, while controlling for the covariate age. Significant differences between high and low impulsive consumer behavior groups were observed in EFI impulse control, $F(1,1208)=1183.72$, $p < .001$, $\eta^2=.507$, and EFI organization, $F(1,1208)=1239.75$, $p < .001$, $\eta^2=.495$. Individuals with higher impulsive consumer behavior scored lower in EFI Organization and Impulse Control, as evidenced in Table 2.1. No significant differences were observed between the extreme groups in EFI strategic planning, motivational drive, or empathy (see Table 2.1).

Table 2.1 EFI and High vs. Low Impulsive Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Motivational Drive	Low	3.388	.029	3.332	3.444
	High	3.649	.028	3.594	3.704
Organization*	Low	3.839	.035	3.771	3.907
	High	2.135	.034	2.068	2.201
Strategic Planning	Low	3.306	.025	3.257	3.354
	High	3.760	.024	3.713	3.808
Impulse Control*	Low	3.709	.033	3.644	3.773
	High	2.125	.032	2.062	2.189
Empathy	Low	3.640	.029	3.584	3.696
	High	3.891	.028	3.836	3.946

A series of one-way ANCOVAs were also performed to compare means of all five measures of personality (openness, agreeableness, conscientiousness, neuroticism, and extroversion) between high and low groups of impulsive consumer behavior. There were significant differences between high and low impulsive consumer behavior for conscientiousness $F(1,1208) = 263.89$, $p < .001$, $\eta^2=.179$, but not the other measures of personality (see Table 2.2).

Table 2.2 Personality Measure and High vs. Low Impulse Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Neuroticism	Low	5.990	.098	5.797	6.183
	High	7.748	.096	7.559	7.938
Openness	Low	9.636	.095	9.450	9.822
	High	8.872	.093	8.689	9.054
Conscientiousness*	Low	11.209	.102	11.010	11.409
	High	8.896	.100	8.700	9.092
Agreeableness	Low	10.019	.092	9.838	10.199
	High	8.651	.090	8.474	8.828
Extroversion	Low	7.872	.102	7.672	8.071
	High	8.161	.100	7.965	8.356

One-way ANCOVAs demonstrated a significant difference between high and low impulsive consumer behavior groups on Impulse Action, $F(1,1209) = 749.40$, $p < .001$, $\eta^2 = .383$, indicating those who scored highest in impulsive consumer behavior were significantly higher in BIS-8 motor impulsiveness than those who were lower in impulsive consumer behavior. No significant differences between high and low consumer behavior groups was seen for Impulse Plan were identified (see Table 2.3).

Table 2.3 Impulsivity and High vs. Low Impulsive Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Impulse action*	Low	2.128	.039	2.051	2.205
	High	3.634	.039	3.559	3.710
Impulse plan	Low	2.361	.037	2.288	2.434
	High	1.923	.037	1.851	1.995

2.4 Study 1, Part B

2.4.1 Methods

Participants (N=6,000) were recruited, as in Study 1 Part A, to complete an online survey administered through Survey Sampling, Inc. (SSI) to their existing panel of 4.1 million residents in the United States. Recruitment was conducted by SSI providing an email with details for the study to their existing panel. SSI compensated participants in a manner commensurate with all other surveys available to their existing panel. Volunteers were informed in advance that participation was voluntary and could be discontinued at any point within the survey with no penalty. The survey was administered to the general population of the SSI panel, with no limitations placed on screens, with the exception of a minimum age requirement of 18 years old. All participants completed the survey anonymously and were informed in advance that any answers would be reported in aggregate with other respondents. As part of the contract with SSI, no personally-identifiable information was or will be delivered to the author of this study. The demographics of the SSI panel consist of the following: 50% females, 49% males, and 1% transgender, and broad ranges in age (ages 18 to 96 years; mean 44 years old), education levels (less than high school graduate to doctoral level), and socio-economic status. Ethnicity/race information was not provided in this dataset. Approval was obtained by Georgia State University Institutional Review Board to analyze this archival dataset.

2.4.2 Apparatus and Measures

All apparatus and measures were repeated from Study 1, Part A, with the addition of two consumer-behavior measures of Opportunity Seeking Behavior and Financial Risk Taking, and the removal of spending and value seeking measures.

2.4.2.1 Opportunity seeking behavior. Five statements were placed within the survey

regarding participants' behavior within the last five years. Participants self-reported their frequency of participation using a seven-point Likert scale with response items as follows: 1= never, 2= less than once a month, 3= once a month, 4= 2-3 times per month, 5= once a week, 6= 2-3 times per week, 7= daily. Responses were subjected to a principal components exploratory factor analysis, using Promax rotation with no restrictions on numbers of factors. Loadings less than .4 were suppressed. All items loaded on one factor to account for 88.59% total variability. An overall score was calculated using factor loadings from a factor analysis to weight scores. Each question response was multiplied by the respective factor loading. All scores were averaged for a final Opportunity Seeking score. The Opportunity Seeking statements, with their factor loadings, were: Have you participated in the following within the last five years? Stock Day Trading (.947), Real Estate Flipping (.908), Multi-Level Marketing Businesses (.939), Agreed to co-sign a loan for a stranger in exchange for money (.961), Investment opportunities on Craig's List or any other online listings (.965), Door to door magazine sales (.957), Business opportunities that require an upfront fee (.955), and A side business within your home (Bitcoin, Amway, Address labeling, etc.; .896). Internal consistency was measures using Chronbach's Alpha and found to be (a = .83).

2.4.2.2 Financial risk taking. Two statements created for this study were placed within the survey regarding financial risk-taking behavior. These statements were, "How often do you currently engage in financial risk taking (gambling, risky investments, etc.)?" and "How often have you engaged financial risk taking like gambling or risky investments in your adult past?" Participants self-reported their frequency of participation using a seven-point Likert scale with response items as follows: 1= never, 2= less than once a month, 3= once a month, 4= 2-3 times per month, 5= once a week, 6= 2-3 times per week, 7= daily. Item responses were added for each

participant. These two questions were created for this specific survey and were not replicated in any subsequent survey. Internal consistency testing was conducted on subsets of this study and received Chronbach's Alpha of (a =.82).

2.5 Results

2.5.1 Measure Assessments

2.5.1.1 Impulsivity. As in part A of Study 1, an exploratory factor analysis was used to identify factor loadings and structure for the eight items in the BIS used in these studies. Promax rotation was used, as items were assumed from previous theory and knowledge of the scale to be correlated. No limitation of number of factors were set. Coefficients loading less than .4 were suppressed Replicating the results in the part A exploratory factor analysis on impulsivity, two factors were identified and matched the previously titled Impulse Action (39.71%) and Impulse Plan (24.63%), and cumulatively accounted for 64.34% total variance. As in the previous analysis, the same four items loaded for each factor as follows: I plan tasks carefully (.722, IP); I do things without thinking (.858, IA); I don't "pay attention" (.761, IA); I am self-controlled (.756, IP); I concentrate easily (.791, IP); I am a careful thinker (.838, IP); I say things without thinking (.839, IA); I act on the spur of the moment (.821, IA).

2.5.1.2 Descriptive and bivariate analyses. First, descriptive statistics were calculated for all of the variables. A correlational analysis (Appendix F) was generated between age with all sub measures of the EFI (MD, SP, IC, EM, ORG), credit card misuse, opportunity seeking behavior, and financial risk taking. Age was moderately correlated with subscales of the Executive Function Index (impulse control, r = -.463; organization, r = -.446), credit card misuse (r = .464) and opportunity seeking behavior (r = .388). In the subsequent analyses, age was

controlled for as a covariate. Gender groups were compared for all dependent variables and found to have no significant differences, using independent T-tests (p >.10); thus, it was not necessary to control for gender within subsequent analyses.

After confirmation of normality of distribution of the variables, zero-order correlational analysis (Appendix F) was used to identify relations between the variables of executive function index (EFI), the five-factor personality inventory (TIPI), impulsiveness (BIS-8), credit card misuse, opportunity seeking, and financial risk taking. Moderate to strong correlations were identified between EFI impulse control and Impulse Action (r = .-584) and EFI organization (r = .689); Impulse Plan with conscientiousness (r = .584) and EFI strategic planning (r = -.687), EFI organization with Impulse Action (r = .584), and EFI motivational drive with openness (r = .555).

For subsequent analyses, the composite consumer behavior measure was identified as high, average, and low, using approximately top 10% as high and approximately bottom 10% as low. The remaining 80% of participants were excluded from the extreme-groups analyses. A score for global impulsive consumer behavior was also created by averaging measures of opportunity seeking, financial risk taking, and credit card misuse. High Impulsive Consumers (N=483) ranged in scores from 1 to 1.43, and Low Impulsive Consumers (N=521) ranged in scores from 5.21 to 7.

As in Study 1A, a series of one-way ANCOVAs was performed to identify differences in means of EFI subscales between high and low impulsive consumer behavior. There were significant differences between high and low purchase groups in EFI impulse control $F(1, 1003) = 2{,}910.79$, $p < .001$, $\eta^2 = .744$, and EFI organization $F(1,1003) = 2{,}343.31$, $p < .001$, $\eta^2 = .70$, but not in any other EFI subscales (see Table 2.4).

Table 2.4 EFI and High vs. Low Impulsive Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Motivational drive	Low	3.458	.028	3.403	3.513
	High	3.675	.027	3.622	3.728
Organization*	Low	4.019	.031	3.957	4.080
	High	1.904	.030	1.845	1.963
Strategic Planning	Low	3.587	.022	3.544	3.629
	High	3.838	.021	3.798	3.879
Impulse Control*	Low	4.066	.029	4.009	4.123
	High	1.902	.028	1.848	1.957
Empathy	Low	3.989	.027	3.937	4.041
	High	3.760	.026	3.710	3.811

A series of one-way ANCOVAs were also performed to compare means of all five measures of personality (openness, agreeableness, conscientiousness, neuroticism, and extroversion) between high and low groups of impulsive consumer behavior. There were significant differences between high and low impulsive consumer behavior groups for conscientiousness $F(1,1003) = 1{,}319.35$, $p < .001$, $\eta^2 = .568$, but not the other measures of personality. The possible range of scores for all of the personality measures ranged from 2 to 14 (see Table 2.5).

Table 2.5 Personality and High vs. Low Impulsive Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Extroversion	Low	6.894	.114	6.671	7.118
	High	8.299	.110	8.084	8.515
Agreeableness	Low	10.946	.084	10.781	11.111
	High	8.250	.081	8.090	8.409
Neuroticism	Low	5.507	.098	5.314	5.700
	High	7.653	.095	7.467	7.838
Openness	Low	9.427	.097	9.237	9.616
	High	8.378	.093	8.195	8.561
Conscientiousness *	Low	12.400	.079	12.244	12.555
	High	8.405	.076	8.255	8.555

A series of one-way ANCOVAs was used to compare high and low impulsive consumer group within two types of impulsivity from the BIS-8: Impulse Action and Impulse Plan. Results indicated significant differences between high and low impulsive consumer groups in Impulse Action, $F(1, 1003) = 11{,}834.11$, $p < .001$, $\eta^2 = .647$. No significant differences between high and low impulsive consumer groups were identified for Impulse Plan (see Table 2.6).

Table 2.6 Impulsivity and High vs. Low Impulsive Consumer Behavior Groups

(*p < .001)	Impulsive Consumer Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Impulse action*	Low	1.872	.035	1.804	1.940
	High	3.932	.033	3.867	3.998
Impulse plan	Low	1.953	.028	1.899	2.008
	High	1.719	.027	1.667	1.771

2.6 Study 1 Discussion

According to Spinella (2005a), he created the Executive Function Index in an attempt to generate an efficient and valid self-report measure of executive function for normal populations. Spinella's intent for this measure was for use in large-sample surveys and studies. Through factor analysis, Spinella derived the five sub-factors of impulse control, organization, strategic planning, motivational drive, and empathy. Previous literature cited in this paper would suggest that impulsive consumer behavior should be strongly related to the five subscales of the Executive Function Index that are thought to measure working memory capacity, inhibitory control, and to a lesser extent, cognitive flexibility. In both parts (A and B) of Study 1, impulsive consumer behavior (as measured with various consumer behaviors of opportunity seeking, financial risk taking, spending, value seeking, and credit card misuse combined to make

composite scores) was consistently associated with significant differences in the subscale measures of Impulse Control and Organization within the Executive Function Index, but not in the subscales of Motivational Drive, Strategic Planning, and Empathy. These findings suggest that EFI Impulse Control and Organization may measure some components of executive function as it pertains to or is related to consumer behavior, whereas EFI Motivational Drive, Strategic Planning and Empathy do not.

The results from this study also demonstrated that the measure for impulsivity (BIS-8) reflected two factors for overall impulsivity, called Impulse Action (to reflect motor impulsivity) and Impulse Plan (to reflect non-planning and attention control). This outcome from the exploratory factor analysis is different from the previous factors of non-planning, motor, and attentional impulsiveness earlier identified within the larger Barratt Impulsiveness Measure (Witney, Jameson, & Hinson, 2004). For both datasets in Study 1, groups of high and low impulsive consumer behavior demonstrated differences within Impulse Action but not Impulse Plan. More specifically, the results from this study suggest that the impulsivity related to spending behavior, high risk financial investments, financial opportunity seeking, and value-seeking behaviors reflects impulsive physical activity, motor, or movement like “doing things without thinking.” The other type of Impulsivity called Impulse Plan, which is associated with the absence of planning, careful thinking, and concentration, was not related to consumer behavior.

In addition, the following variables demonstrated moderate-to-strong correlations in both datasets (Parts A and B): EFI Impulse Control and EFI Organization with Impulse Action, EFI Strategic Planning with Conscientiousness and Impulse Plan, and EFI Motivational Drive with Extroversion. These correlations suggest EFI subscales of Impulse Control and Organization are

more closely associated with the type of impulsive behavior (motor impulsivity) related to impulsive consumer behavior, and potentially the components of executive function that can account for motor impulsivity and impulsive consumer behavior. However, these correlations also suggest some subscales of the EFI, specifically Strategic Planning and Motivational Drive, are more closely associated with personality traits (conscientiousness and extroversion) than with executive functions. Furthermore, subscales of Strategic Planning and Motivational Drive appear not to be strongly related with the form of impulsivity related to consumer behavior. For personality, only conscientiousness was found to be related to impulsive consumer behavior in both datasets, as higher conscientiousness was associated with lower impulsive consumer behavior. Conscientiousness was also correlated with Impulse Plan, or impulsivity that results from a lack of planning, but not with motor impulsivity (Impulse Action), or with the subscales of the EFI (organization and impulse control) that seem to measure components of executive function utilized (or not utilized) in impulsive consumer behavior. These findings suggest that impulsive consumer behavior may be informed by not just executive functions but perhaps some personality trait(s) as well, specifically within a type of impulsivity different from the type related and associated with executive functions.

A possible objection to extreme group comparison methodology may be made and can be addressed. The aim of the extreme-group was to see how the most versus least impulsive consumers compared on EFI, personality, and BIS measures. Given the size of the current sample, it was possible to maintain statistical power even with extreme groups consisting of only the top and bottom 10% of the consumer-behavior distribution. However, this does assume that these most-extreme spenders differ from the middle 80% quantitatively and linearly, and not qualitatively. In support of this assumption, Appendices U and V show the means that would

have been obtained had the more traditional quartile splits been used for this analysis. Scores for the measures of interest generally varied systematically between the low- and high-impulsive consumer behavior groups.

As certain EFI subscales demonstrated a relationship with impulsive consumer behavior, the results from this study provide some evidence that measures of EFI organization and impulse control should correlate with working memory capacity and perhaps inhibitory control, respectively; and other subscales of the EFI most likely reflect cognitive flexibility and/or personality traits. In addition, the EFI subscales of organization and impulse control are also measures that relate to impulsive consumer behavior.

3 STUDY 2

3.1 Methods

3.1.1 Participants

Participants (N = 253) were recruited through Mechanical Turk for Amazon. At any point during their participation, volunteers were able to skip a question or choose not to finish without penalty. Consent was gained prior to participation. Participants in this study ranged in age from 18 to 89, with a mean age of 38.5 years. Of the participants, 60% were male, 39% were female, and .4% transgender, and the remaining preferred not to answer. Participants identified their primary race/ethnicity as follows: 50.3% of participants identified their ethnicity as Caucasian or White, 21.7% identified as African-American or Black, 3.6% as Hispanic, 2.0% as Asian, .8% as other, and 21.4% preferred not to answer. Average overall response time to the study was 37 minutes. Participants whose overall response time was less than seven minutes were removed from the study (n=11) to ensure thoughtful and deliberate responses from individuals. Participants were given a one-hour time limit to complete the study. Approval to conduct this research study was obtained by Georgia State University Institutional Review Board prior to collecting any data.

3.1.2 Apparatus and Measures

A web link generated by Psytoolkit was posted in Mechanical Turk and in Sona Systems for Georgia State University for recruitment. Psytoolkit is an open access, privately owned website that offers psychological experiments and surveys, all previously validated, for use in research. As part of the testing sequence, participants also completed other tasks (e.g., Iowa Gambling Task) that are not part of the current study. All measures and questions were administered via participants' personal computers. After obtaining demographic information,

including age, gender, and racial/ethnic identification, the following behavioral tests and self-report measures were administered:

3.1.2.1 Purchasing behavior. A series of questions were interspersed within the experiment to simulate a purchasing experience of a personal mobile device. For the first question, participants were asked to quantify a budget for this purchase. Thirteen subsequent questions offered additional upgrades for the mobile device as well as a second tablet, all for additional cost. All of these questions are listed in Appendix U. The measure for this task was calculated with a numerical value for responses of "yes" and "no." An additional measure was calculated between the difference of budget established at the beginning of the survey and the total money spent at the end of the study.

3.1.2.2 Corsi. The Corsi Block Test, similar to digit-span tasks, is a task that presented nine blocks or shapes sequentially. Participants were instructed to remember the order of sequential presentation and replicate at their own pace. The number of trials for this task was based on the success of the previous trial. At a minimum, participants completed two trials with two-block spans, which were presented first. A total of 20 Corsi trials would be administered if an individual successfully achieved each iteration up to a nine-block span. Participants had to respond correctly on two consecutive trials of each span to confirm success of that span length, and to move to a larger span. The presentation of stimuli was set at 500 milliseconds per block with a countdown before the first block display. The dependent measure for this task was the highest span length a participant achieved. This span measure was considered an estimate of working memory capacity. Most healthy adults will score between a 5- and 7-item span on the manual version of this task (Corsi, 1972). This task was administered twice within the study, and

the average participants' Corsi span from both administrations was calculated and used in subsequent analyses.

3.1.2.3 Task/attention-switching. Attention shifting tasks may reflect set-switching or cognitive flexibility and are considered one measure of executive function. The GRID task used in this study (a version of the Letter-Number task described by Rogers and Monsell, 1995) involves a numeral-letter pair displayed in 2000 milliseconds in one of four cells of a 2x2 grid on the screen. If the characters appear in one of the top two cells, participants must indicate whether the numeral is odd or even. If the characters appear in either of the bottom cells, participants must respond by pressing letter "B" or "N," depending on whether the letter is consonant or vowel. Repeated trials with either rule are used to establish a baseline speed for making the odd/even or consonant/vowel judgment. Set-switching trials occur whenever the rule for trial N is different than the rule for trial N-1. The difference between these response times (switch time) provides a measure of cognitive flexibility, such that shorter switch times indicated higher cognitive flexibility. For this study, a set of 20 practice trials for letters only on the top two cells and then another set of 20 trials for numbers only on the bottom two cells were given prior to 100 complete trials of both letters and numbers, with the cell selected randomly for each trial from the entire grid. This task provides measurements of two types of performance cost: mix cost and switch cost. Mix cost is the performance cost to mix two different tasks, and switch cost is the performance cost to switch between two sequentially presented tasks.

3.1.2.4 N-Back. The N-Back task is a behavioral measure that was introduced by Wayne Kirchner (1958). This measure is used primarily as a measure of working memory capacity. The task requires a participant, while being presented with a sequence of stimuli, to identify whenever a current stimulus matches a stimulus N positions back in the sequence. Thus,

participants are required in this task continuously to update their working memories to keep track of the most recent N items to compare to the current stimulus. To do so, participants must both hold and manipulate information to be successful. For this study, the N was set to 3-back in the sequence. Two sets of 50 trials of N-back were given, each at a 500-millisecond display of each letter in the sequence.

3.1.2.5 Stroop. The Stroop task has been a standard for measuring inhibitory control since developed by Stroop (1935). The color-word task requires individuals to identify the font colors of color words and is a measure of executive attention and inhibitory control. Within this task, there are trials in which the color used to display the word is either same (congruent) or different (incongruent) to the meaning of the color word. The difference in response times between incongruent and baseline trials (or sometimes, as was done here, between incongruent and congruent trials) is identified as the Stroop effect, and reflects the cost of interference from the irrelevant cue (word meaning) on the attended cue (word color; Stroop, 1935). For this study, participants completed 40 trials. Colors/words used were yellow, blue, red, and green. Stimuli were presented and participants were required to respond by pressing the *y*, *r*, *b*, or *g* key based on color of the word within 2000 ms. After a response, a new trial was presented within 500 seconds. The Stroop task in Psytoolkit was written to include 27% congruent trials and 63% incongruent trials, in random order.

3.1.2.6 Go/No-Go. Go/No-Go tasks can be a measure of impulsivity, as participants are required to inhibit a habitual response. In this particular version, participants were given a cue of *Go* and required to respond by clicking the space bar. A cue of *No-Go* was also given in which participants were not to respond. Difficulty was increased by presenting more Go cues than No-

Go cues. Errors and response times are used for the measure of behavioral inhibition. This task presented 20 Go trials and five No-Go trials.

3.1.2.7 Stop Signal. The Stop Signal task (Lappin & Erickson, 1966) is a variation of Go/No-Go and is used to measure inhibitory control. For this particular version, participants were required to respond with either letters *b* or *n*, depending on whether the cue (arrow) was pointing left or right, respectively. Responses were required within 500 milliseconds of stimulus presentation, and feedback was given after 250 milliseconds. The response-offset asynchrony was 2000 milliseconds after a wrong response, with no delay after a correct response. After a training phase, a red circle (stop signal) appeared on some trials, in which participants are not to respond to the direction of the arrow. False-alarms (errors) in response were considered measures of inability to inhibit response. A total of 50 go trials and 20 stop-signal trials, in random order, were given in this task.

3.1.2.8 Wisconsin Card Sort. The Wisconsin Card Sort Task used for this study is grounded in Grant & Berg's (1948) version used to measure cognitive flexibility. For this study, participants were presented with four cards that could be classified in three different ways: color of symbols on the card (yellow, blue, green, or red), shape of the symbols (circle, start, cross, triangle), or number of symbols (one, two, three, four) on each card. The classification rule changed every ten cards. Thus, the task required participants to figure out the sorting rule via trial-and-error, and then to switch to a new rule when necessary. The task measures how well an individual adapts to changing rules, with perseverations (repeated attempts with an old rule) as a measure of cognitive (in)flexibility. For this particular version, participants were given up to ten seconds to respond to each card before a new trial was presented. A total of 74 trials were given

in this task. Visual and auditory feedback (either “correct” or “wrong”) was provided for 500ms after each trial so that participants could learn the classification rule.

3.1.2.9 Other measures. The measures for Impulsiveness, Credit Card Misuse, Five Factor Personality Inventory, and Executive Function Index were the same self-report measures utilized in the Study 1, parts A and B. These items are exhibited in Appendices A, B, C, D, and E. Questions for the purchasing task are exhibited in Appendix U.

3.1.2.10 Procedure. All surveys were completed online, and participants were compensated five dollars when recruited through Mechanical Turk. The entire study was administered through a link to the host website (psytoolkit.org). The subsequent order of questions and experiments are listed in Appendix I.

3.2 Results

First, demographics were measured to determine whether there were any significant effects of age, gender, and ethnicity/race on all other variables, including the dependent variables of purchasing, and credit card misuse (See Appendix L & M). Some of the correlations with age were significant (age correlations range: -.023 to .27), so age was controlled as a covariate in all subsequent ANOVAs. No significant differences between gender or race/ethnicity groups were observed in a series of independent samples *t*-tests ($p >$. 16); consequently, subsequent ANOVAs did not include these grouping variables.

Means and standard deviations were calculated for the variables of Executive Function Index (EFI), the Five Factor Personality Inventory, the BIS-8, and all behavioral computerized tasks (N-back, Corsi, Stop Signal, Task Switching, Stroop, Wisconsin Card Sorting, and Go/No-Go; see Appendix K for descriptive statistics).

3.2.1 Correlations Between EFI, Executive Function, and Personality

Next, zero-order correlations were calculated to investigate the associations between the indicators of working memory (N-Back and Corsi), cognitive flexibility (Task Switching and Wisconsin Card Sorting), and behavioral inhibition (Stroop, Go/No-Go, and Stop Signal), Big Five Personality Traits, and Indicators of Impulse Plan and Impulse Action from the BIS-8. There were significant correlations, as expected, between measures of each component; however, all of the correlations would be considered weak. For working memory, N-back false positives were negatively correlated with Corsi mean, $r(253) = -.235$, $p < .001$, and positively correlated with N-back misses, $r(253) = .218$, $p < .001$. Within measures of inhibitory control, Go/No-Go response times were correlated with Go/No-Go error rate, $r(253) = -.174$, $p = .005$, and Stop Signal error rate, $r(253) = -.159$, $p = .011$, but were not significantly correlated with Stroop accuracy or response-time interference measures. There were no significant correlations between measures from the GRID and Wisconsin Card Sorting task.

In order to identify how much variability in the Executive Function Index was associated with the behavioral measures of executive function used in Study 2, bivariate correlations were also calculated between EFI subscales of motivational drive (EFI MD), strategic planning (EFI SP), organization (EFI ORG), and impulse control (EFI IC), and each measure from the behavioral tasks. The full correlational analyses are displayed in Appendices H, I, and J. Some of the significant correlations that are relevant to the primary hypotheses are highlighted here. Significant correlations were observed between N-back misses and EFI IC $r(253) = -.20$, $p = .002$, and EFI ORG $r(253) = -.16$, $p = .011$, between GO/NO-GO response times and EFI ORG $r(253) = -.14$, $p < .023$, and between Stop Signal error rate and EFI IC $r(253) = -.16$, $p = .01$, and EFI ORG $r(253) = -.220$, $p < .001$. Wisconsin Card Sort perseveration error rate correlated

significantly with EFI IC, $r(253) = -.17$, $p = .007$, and ORG $r(253) = -.12$, $p = .049$. Task-switching MixCost and EFI IC correlated significantly as well, $r(253) = .17$, $p = .007$. It is interesting to note that no significant correlations were found between the two EFI subscales of Motivational Drive (MD) and Strategic Planning (SP) and the behavioral tasks selected to measure the executive functions of cognitive flexibility, working memory, and inhibitory control. These findings from the correlational analyses are displayed in Appendix P.

To test what relations might exist between the Executive Function Index and the Five Factor Personality Inventory, zero-order correlations were examined. Although most relationships were found to be significant, almost all demonstrated weak correlational effects of $r < .40$. EFI Organization was found to correlate with all five personality dimensions: extraversion $r(253) = .18$, $p < .004$, agreeableness $r(253) = .36$ $p < .001$, conscientiousness $r(253) = .34$, $p < .001$, openness $r(253) = .29$, $p < .001$, and neuroticism $r(253) = .36$, $p < .001$. EFI Impulse Control was positively correlated with agreeableness $r(253) = .33$, $p < .001$, conscientiousness $r(253) = .22$, $p < .001$, and neuroticism $r(253) = .18$, $p < .001$. Strategic Planning correlated with extroversion $r(253) = .23$, $p < .001$, agreeableness $r(253) = .28$, $p < .001$, conscientiousness $r(253) = .53$, $p < .001$, neuroticism $r(253) = .29$, $p < .001$, and openness $r(253) = .20$, $p < .01$. Motivational Drive correlated with extraversion $r(253) = .63$, $p < .001$, agreeableness $r(253) = .34$, $p < .001$, conscientiousness $r(253) = .36$, $p < .001$, neuroticism $r(253) = .44$, $p < .001$, and openness $r(253) = .55$, $p < .001$. It is important to note that the variables that showed moderate-to-strong correlations with personality measures were also the two EFI subscales (strategic planning and motivational drive) that did not correlate with the behavioral measures of executive function used in Study 2. A partial correlation was run between all five measures of personality and the three composite scores of executive function: working memory (Nback and Corsi),

inhibitory control (Stopsignal, Go/Nogo, and Stroop), and cognitive flexibility (WCT and Taskswitching). Inhibitory control was correlated with conscientiousness $r(235) = -.160$, $p = .011$, and working memory was correlated significantly with extraversion, $r(253) = .171$, $p = .007$.

Finally, a partial correlation was performed between the EFI subscales, the composite scores of cognitive flexibility, inhibitory control, and working memory, while controlling for the five scales of personality. All correlations between EFI subscales and EF composite measures were not significant when controlling for personality, except for the relationship between EFI Organization and inhibitory control. This correlation was significant, $r(253) = -.150$, $p = .019$.

3.2.2 Extreme-Groups Analyses.

For the subsequent analyses, quartile splits were used to separate participants into groups. Composite scores for working memory capacity were created by calculating the averaged z-scores of the working memory (WM) measures (Corsi max, reverse scored, and N-back misses). One-fourth of the original participants were considered to have high WM (n = 61, *z* range -1.21 to -0.35), and one-fourth were considered to have low WM (n = 64, *z* range 0.27 to 1.42). The remaining participants (n = 128) were not included in the extreme-groups analyses. In addition, high/low categories were similarly created using quartile splits for the composite of inhibition. Scores were tabulated by averaging z-scores of Stroop interference, Stroop error, Go/No-Go error, and Stop signal error. Approximately one-fourth of participants were considered to have low inhibitory control (n=79, *z* range 24 to 1.47), meaning they had more error and interference rates, and one-fourth of participants were considered to have high inhibitory control (n=86, *z* range -.29 to -.89) in that their scores showed less interference and lower error rates. High and low categories for cognitive flexibility were also calculated by averaging the z-scores of

Wisconsin Card Sort perseveration error and Task switching switch cost. Approximately one-fourth of participants were considered to have low cognitive flexibility (n= 64, z range -1.58 to -.51), and approximately one-fourth of participants were considered to have high cognitive flexibility (n= .36 to 4.5).

Various derived measures were calculated within the purchasing task for Study 2. For impulsive purchasing behavior, a measure was created by adding the number of yes or no responses to the purchasing task questions. The responses were tallied with numerical value of 2 for yes, and 1 for no. The scores were then coded into groups of high/average/low purchase. The bottom quartile of participants was considered to be low spenders (n = 72, range 12-21), and the top quartile was considered to include high spenders (n = 63, range 24-28). This measure was named "Times Purchased." Second, a simple addition of all money amounts a participant indicated they were willing to spend was calculated and called "Purchase Total." Third, the total amount a participant purchased minus the amount participants reported as purchased at the end of the task was calculated and named "Purchase Total Known." This is how accurately participants remembered the amount of money they had been willing to spend. Fourth, the total amount purchased minus the original budget was calculated and called "Purchase Difference 1." A fifth calculation was made by subtracting the participants reported budget at the end of the survey from the actual amount spent to that point. This calculation was "Purchase Difference 2." The final calculation was made by subtracting the reported budget at the end of the survey (Q16) from the initial amount budgeted at the beginning of the survey (Q1) and was titled "Budget Difference." This is a measure of how well participants remembered their original budget. For each of these purchasing-behavior measures, extreme groups were formed using quartile splits.

For all subsequent analyses, an alpha level of .001 was established for significance in order to address multiple comparisons and analyses.

3.2.3 EFI Effects on Executive Function

A series of one-way ANOVAs were performed to identify differences between high and low extreme groups of each of the Executive Function Index on the three composite scores developed for cognitive flexibility, working memory, and inhibitory control. Of these analyses, there were significant differences between high and low groups of EFI Organization on inhibitory control, $F(1,136) = 9.50$, $p = .001$, $\eta^2 = .056$; although the effect of EFI Impulse Control on working memory approached this threshold, $F(1,135) = 7.174$, $p = .002$, $\eta^2 = .053$. These results indicate individuals who scored high in Organization on the EFI were significantly higher in inhibitory control in behavioral tasks. Table 3.1 and Table 3.2 demonstrate these findings. No significant differences were found in extreme-groups analyses of the other EFI subscales.

Table 3.1 EFI Organization Extreme Groups on Executive Function

				95% Confidence Interval	
Dependent Variable	EFI Organization Score	Mean	Std. Error	Lower Bound	Upper Bound
Cognitive Flexibility	High	.133	.090	-.045	.312
	Low	-.073	.084	-.239	.092
Working Memory	High	.155	.078	.002	.309
	Low	-.043	.072	-.186	.100
Inhibitory Control*	High	.120	.053	.016	.225
	Low	-.102	.049	-.199	-.005

Table 3.2 EFI Impulse Control Extreme Groups on Executive Function

	EFI Impulse Control Score	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Cognitive flexibility	Low	.077	.099	-.118	.272
	High	.108	.094	-.078	.293
Working Memory*	Low	-.082	.073	-.225	.062
	High	.201	.077	.050	.352
Inhibitory Control	Low	-.027	.052	-.130	.077
	High	.114	.055	.005	.230

3.2.4 Purchasing Behavior Effects on Executive Function

A series of one-way ANCOVAs, with a covariate of age, were used to identify differences between extreme groups of purchase total on composite executive function components of working memory, inhibitory control, and cognitive flexibility. Within the univariate analyses, a significant difference was identified between high and low groups of purchase total for the working memory composite, $F(1,137) = 18.62$, $p < .001$, $\eta^2 = .12$. The high and low purchase total groups did not differ significantly in inhibitory control or cognitive flexibility (see descriptive statistics in Table 3.3).

Table 3.3 Purchase Total Extreme Groups on Executive Function

				95% Confidence Interval	
	Total Purchase	Mean	Std. Error	Lower Bound	Upper Bound
Working Memory*	Low	.230	.065	.100	.359
	High	-.190	.072	-.332	-.048
Inhibitory Control	Low	.026	.059	-.090	.142
	High	.116	.054	.011	.222
Cognitive Flexibility	Low	-.116	.086	-.286	.054
	High	.066	.078	-.088	.221

3.2.5 Executive Function Effects on Purchasing Behavior

Similarly, a series of one-way ANCOVAs were used to identify differences between extreme groups of working memory on all of the measures for purchasing. Within the univariate analyses, five significant differences between high and low working memory groups were identified. First, a significant difference was found between working-memory groups on purchase total, (how much the participants actually spent), $F(1,124) = 26.91$, $p < .001$, $\eta^2 = .216$. Second, a significant difference was observed between groups on purchase total known (how accurately participants recalled the amount they spent), $F(1,124) = 21.82$, $p < .001$, $\eta^2 = 117$. Third, a significant difference was identified between the high and low WMC groups on purchase difference 1 (the difference between the amount participants actually purchased and how much they reported their budget to be at the beginning of the survey), $F(124) = 28.31$, $p < .001$, $\eta^2 = 211$. Fourth, there was a significant difference between WMC groups for purchase difference 2 (the difference between the amount participants spent and what they remembered and reported their original budget to be at the end of the survey), $F(1,124) = 20.15$, $p < .001$, $\eta^2 = .184$. A final significant difference was between WM groups in times purchased (the total

number of times they chose to purchase), $F(1,124) = 18.04$, $p < .001$, $\eta^2 = .145$. Descriptive statistics for these comparisons are shown in Table 3.4.

Table 3.4 Working Memory Extreme Groups on Executive Function

Dependent Variable	Working Memory	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Purchase Total*	High	411.016	52.261	307.576	514.455
	Low	797.500	53.097	692.405	902.595
Purchase Total Known*	High	-25.531	55.754	-135.884	84.822
	Low	345.742	56.646	233.623	457.861
Purchase Difference*	High	101.250	50.802	.699	201.801
	Low	486.565	51.615	384.405	588.724
Purchase Difference* Two	High	-29.547	65.432	-159.056	99.962
	Low	397.565	66.479	265.983	529.146
Budget Difference	High	-130.797	42.486	-214.888	-46.705
	Low	-89.000	43.166	-174.437	-3.563
Times Purchased*	High	20.952	.413	22.635	24.271
	Low	23.453	.420	20.121	21.782

A series of one-way ANCOVAs were conducted to identify meaningful differences between high and low groups of inhibitory control or high and low groups of cognitive flexibility within all of the purchasing measures. No significant differences were identified ($p > .10$ for all).

3.2.6 EFI Effects on Purchasing Behavior

Quartile splits were used to form high and low groups on each of the EFI subscales, and then a series of one-way ANCOVAs were performed to identify differences between high and low EFI subscales of impulse control, organization, strategic planning, empathy, and motivational drive groups on purchasing behavior measures. For these quartile splits, high indicates better or more impulse control, organization, strategic planning, empathy, and motivational drive. Only the EFI Organization subscale demonstrated significant differences in

purchasing behavior. High and low groups of EFI Organization were significantly different for the purchasing measures of purchase total, $F(1,140) = 10.79$, $p = .001$, $\eta^2 = .072$, and on times purchased, $F(1,140) = 11.12$, $p = .001$, $\eta^2 = .075$. Participants in the low EFI Organization group spent significantly more and made significantly more purchases than high EFI Organization participants, as is shown in Table 3.5.

Table 3.5 EFI Organization Extreme Groups comparisons on Purchasing Behavior

				95% Confidence Interval	
Dependent Variable	Organization	Mean	Std. Error	Lower Bound	Upper Bound
Purchase Total*	Low	672.109	52.160	568.973	775.246
	High	439.605	47.865	344.961	534.250
Purchase Total Known	Low	194.391	54.316	86.991	301.790
	High	10.789	49.844	-87.767	109.346
Purchase Difference	Low	344.641	52.394	241.041	448.240
	High	121.184	48.080	26.115	216.254
Purchase Difference Two	Low	239.281	63.657	113.411	365.151
	High	-21.592	58.416	-137.098	93.914
Budget Difference	Low	-105.359	42.017	-188.440	-22.279
	High	-142.776	38.557	-219.016	-66.536
Times Purchased*	Low	23.316	.384	20.819	22.337
	High	21.578	.352	22.619	24.012

3.2.7 Executive Function Effects on Impulsivity.

However, in a series of ANCOVAs, participants in the high and low groups of inhibitory control demonstrated significant differences for impulse action, $F(1,128) = 13.228$, $p < .001$, $\eta^2 = .178$, but not impulse plan, $F(1,128) = .185$, $p = .852$, $\eta^2 = .003$. High and low groups of

cognitive flexibility and working memory demonstrated no significant differences in either impulse action or impulse plan, although the working memory comparison for impulse action (p = .002) approached the conservative threshold set for these multiple comparisons, as shown in ***Error! Reference source not found.****. Participants high in inhibitory control scored significantly more in impulse action, as shown in*

Table 3..

Table 3.6 Inhibitory Control Extreme Group Comparison on Impulsivity

				95% Confidence Interval	
	Inhibition	Mean	Std. Error	Lower Bound	Upper Bound
Impulse Plan	High	5.600	.504	4.602	6.598
	Low	6.286	.512	5.272	7.300
Impulse Action	High	7.877	.609	6.673	9.081
	Low	11.032	.618	9.808	12.255

Table 3.7 Working Memory Extreme Group Comparison on Impulsivity

				95% Confidence Interval	
	Working Memory	Mean	Std. Error	Lower Bound	Upper Bound
Impulse Plan	High	6.000	.558	4.895	7.105
	Low	5.758	.567	4.635	6.881
Impulse Action	High	8.094	.628	6.851	9.336
	Low	10.984	.638	9.722	12.246

Table 3.8 Cognitive Flexibility Extreme Group Comparison on Impulsivity

				95% Confidence Interval	
	Cognitive Flexibility	Mean	Std. Error	Lower Bound	Upper Bound
Impulse Plan	Low	6.292	.513	5.276	7.308
	High	5.627	.567	4.505	6.749
Impulse Action	Low	9.903	.646	8.626	11.180
	High	8.831	.713	7.420	10.241

3.3 Discussion

Spinella (2007) claimed that EFI measures executive function. The correlational results from Study 2 offer some evidence regarding the accuracy of that claim. On the one hand, the results revealed that measures of EFI Organization and Impulse Control subscales were correlated with performance-based measures of working memory and inhibitory control. On the other hand, these correlations were very weak, and the other subscales of the EFI were unrelated to executive function task performance. At most, it may be inferred that only EFI Organization and Impulse Control measure some aspects of the executive function components described by Miyake and Friedman (2012).

It is noteworthy, however, that subscales of the EFI demonstrated stronger correlations with the Five Factor Personality measures than the behavioral measures of working memory capacity, inhibitory control, and cognitive flexibility. To test whether or not the differences in these correlations were significant, *z*-tests were performed on the highest scoring correlation for the EFI subscales and compared between the behavioral measures and personality scales. These comparisons found there was no significant difference between the correlations between Impulse Control and Nback misses and Agreeableness, $p = .1236$. For Organization, there was a significant difference between correlations with Stop Signal and Agreeableness, with Stop Signal being the higher correlation, $p = .0418$. For both Strategic Planning and Motivational Drive, the correlations with all behavioral measures were not significant. The comparisons between *r* scores of the strongest correlation with a behavioral measure of executive function and conscientiousness ($p = .0274$) and extroversion ($p = .0183$), respectively, demonstrated significant differences. Thus, it can be argued that the Executive Function Index is more strongly correlated with personality measures rather than executive function.

These findings suggest that the EFI, while somewhat measuring executive functions through the two subscales of Impulse Control and Organization, may be more successful at measuring either personality traits or a common variable that informs both executive function and personality with the two subscales of Motivational Drive and Strategic Planning.

These results may be at least partially accounted for by method variance, or mono-method bias, given both the EFI and Big Five measures are self-report surveys. That is, variables that affect self-report instruments—whether those variables reflect temperament (e.g., openness and conscientiousness may influence how one responds to self-report items, irrespective of scale) or cognition (e.g., memory failures or biases might influence what gets reported, irrespective of the topic of the scale)—might be common across instruments, and thus inflate the inter-correlation of self-reports. Researchers have attempted to minimize these effects by using various methods, for instance by using partial correlation methodology. Thus, this paper is limited in acknowledging and addressing how much of the correlations between the EFI and the Big Five can be accounted for in common method variance, as well as whether or not the correlations between the behavior tasks in EF used in this study with the EFI (Lindell & Witney, 2001; Spector, 2006).

A third possibility is that personality traits moderate or mediate relationships with components of executive function. In particular, self-insight and response to self-report may (and most likely would be) influenced by current knowledge of one's personality. The literature on the relation between personality and EF is growing in size but not in clarity. Significant relationships between personality dimensions and particular executive functions have been reported, but typically not replicated (e.g., Buchanan, 2015; Soubelet & Salthouse, 2010; Unsworth et al., 2009; Williams, Suchy, & Rau, 2009). For example, Williams et al. (2009)

summarized evidence and arguments that conscientiousness and EF reflect common neurocognitive systems, and Buchanan (2015) reported some evidence to support such a relationship; however, Soubelet and Salthouse (2011) and Unsworth et al. (2009) found no relationships between EF tasks and conscientiousness (as the present findings corroborated) but rather reported a relationship between EF and openness. The only thing that seems clear at this point is that the personality-EF relationship remains unclear.

Nevertheless, it could be proposed that executive function (as measured by Spinella's index) informs or modulates the constructs of personality traits, as measured in the five-factor personality inventory, or vice versa. In order to test this possibility, a partial correlation was performed between the EFI subscales, the composite scores of cognitive flexibility, inhibitory control, and working memory, while controlling for the five scales of personality. Of all the possible correlations, the relationship between EFI Organization and inhibitory control was significant, $r(253) = .019$. Thus, it can be argued that all but one of the subscales within the EFI measure personality traits rather than executive function constructs.

The high and low EFI subscale comparisons substantiate the one significant partial correlation previously identified. The significant difference between high and low EFI Organization on inhibitory control offers additional support that the EFI Organization subscale is the one part of the EFI that demonstrates the ability to measure some executive function, in particular, inhibitory control. In addition, the EFI Organization was also the only subscale that demonstrated differences in consumer behavior between high and low groups. However, the additional subscales of the EFI demonstrated no significant differences within groups on executive functions. Consequently, the correlational results from this study, as well as extreme group comparisons, offer minimal evidence of the Executive Function Index as a strong and

valid measure of executive function, at least as measured with the present tasks that were selected to reflect Miyake and Friedman's (2012) model.

A different picture emerges from the between-groups comparisons of task performance, summarized in

Table 3.. Results from the purchasing task within Study 2 indicate significant differences between working memory groups (as measured by a composite score of Corsi and N-back tasks) on consumer behavior. In fact, extreme groups formed on working memory scores differed not only in how often an individual chose to purchase, but also how much hypothetical money was spent, the difference between the participant's stated budget and the amount spent, as well as how well the participant kept a running tally of the amount spent or remembered what their initial budget was at the time they finished the tasks. Individuals who scored higher in working memory were more successful in self-regulatory behaviors in the purchasing task by using updating and monitoring skills more successfully than individuals with lower working memory. These results support the common finding that working memory capacity is closely related to self-regulatory behavior (Barratt, 2004; Hinson, Jameson, & Whitney, 2003; Ilkowska & Engele, 2010; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; Hofmann, Schmeichel, & Baddeley, 2012; Witney, 2003).

Table 3.9 Summary of extreme-groups differences from Study 2

High Working Memory		Low Working Memory
	<Purchase Total	
	<Impulsive Purchase	
	<Purchase Difference	
	<Purchase Total Known	
High Purchase Total		Low Purchase Total
	<Working Memory	
High Inhibitory Control		Low Inhibitory Control
	<Impulse Action	
	>Working Memory	
High EFI Organization		Low EFI Organization
	<Purchase Total	
	<Impulsive Purchase	
	>Inhibitory Control	

Regarding personality traits and consumer behavior, Study 2 did not replicate the relationship between conscientiousness and impulsive consumer behavior identified in both parts of Study 1. A strong correlation between EFI Strategic Planning and Conscientiousness was identified, but neither were significantly associated with any measures of consumer behavior within Study 2. In addition, the EFI measures of Motivational Drive and Strategic Planning, which correlated with personality instead of executive function as measured by cognitive measures, were not significantly related to consumer behavior either.

Thus, within Study 2, behavioral measures that were selected because they are widely used to measure the executive-function component of working memory were shown to be related

to consumer behavior. However, almost all EFI measures failed to display any relationship with consumer behavior. Again, this seems consistent with the interpretation of EFI as a personality measure rather than a reliable measure of some executive cognitive ability or operation.

For self-reported impulsivity (measured by the BIS-8), both inhibitory control and working memory revealed differences for Impulse Action but not for Impulse Plan. In addition, the EFI subscales of Organization and impulse control were also measures that relate to impulsive consumer behavior. These results somewhat replicate the findings by Witney, Jameson and Hinson (2004) that working memory capacity and inhibitory control are associated with overall impulsiveness and, more specifically, motor impulsiveness. However, they differ in that working memory capacity correlates with non-planning impulsiveness but not attentional, and vice versa for inhibitory control. These results also align with Barrett and colleagues' proposal (2003) that variability within self-regulatory behaviors of individuals is an outcome of participants' ability to override the automatic, habit driven processing by using executive function resources. Relevant to the present study, variability in impulsive consumer behavior can be accounted for by an individual's executive function abilities, and, as Barratt and colleagues suggested, those resources are working memory capacity and inhibitory control.

Thus, the results from Study 2 replicate findings from Study 1 and provide some additional evidence that the self-report measures of EFI Organization and EFI Impulse Control and the executive function tasks of working memory and perhaps inhibitory control (while not correlating strongly) reflect some common behaviors and cognitive processing, and other subscales of the EFI reflect cognitive flexibility and/or personality traits. Furthermore, the measures of EFI Organization and impulse control also demonstrate relations with impulsive consumer behavior similarly but not as strongly as the behavioral cognitive assessments of

working memory and inhibitory control. It is interesting to note that, as in Study 1, of the two types of impulsivity, Impulse Action was found to be significantly related with inhibitory control, with differences in working memory capacity also approaching the conservative threshold for statistical significance.

Finally, the results indicate that, of the three components in Miyake and Friedman's (2012) model for executive function, working memory was found to be most strongly related to self-regulation as reflected in consumer behavior. Relevant to the present study, variability in impulsive consumer behavior can be accounted for by an individual's executive function resources available at any moment. As Barratt (2004) suggested, and as the findings from this study indicate, these resources appear to be working memory, or updating, as in Miyake & Friedman's framework.

4 GENERAL DISCUSSION

Table 4.1 below summarizes the similarities and differences in findings from the studies reported here. This investigation represents a new and unique attempt to identify and to understand the relations between cognitive abilities, personality traits, and impulsive consumer behavior. The goals of this present investigation were threefold. The first goal was to investigate the relationship between executive function as measured by Spinella's (2004) self-report measure (the Executive Function Index) with personality traits and impulsive consumer behavior. The second goal was to investigate the relationship between executive function, as measured by standard cognitive assessments, with personality and consumer behavior. The final goal was to test the validity of the Executive Function Index (Spinella, 2004) for measuring Miyake and Friedman's (2012) Unity/Diversity model of executive function, as measured by behavioral assessments. In other words, to understand how the EFI relates to executive function measured by cognitive assessments.

Table 4.1. Comparison of primary results from Studies 1A, 1B and 2.

Study 1A and Study 1B	**Study 2**
EFI Impulse Control and EFI Organization were correlated with Impulse Action. ***	EFI Impulse Control, EFI Organization, Working Memory and Inhibitory Control were correlated with Impulse Action. ***
EFI Impulse control and EFI Organization were correlated with individual impulsive consumer behavior measures. *	EFI Impulse Control and EFI Organization were the only self-report measures of the EFI that correlated with cognitive measures. *
EFI Strategic Planning was correlated with Impulse Plan. *	All EFI measures were more strongly correlated with personality measures than cognitive assessments. *
Conscientiousness was correlated with EFI Organization and Impulse Action. **	Conscientiousness was correlated with EFI Strategic Planning and Impulse Plan. **
EFI Motivational Drive was correlated with both Openness and Extroversion. ***	EFI Motivational Drive was correlated with both Openness and Extroversion. ***
EFI Organization and EFI Impulse Control extreme groups demonstrate differences in consumer behavior. People who scored lowest in EFI ORG and EFI IC reported significantly more impulsive consumer behavior than people with high scores. ***	Working Memory tasks and EFI Organization high and low groups demonstrate similar differences in consumer behavior. Differences replicate findings in Study One. ***
	EFI Impulse Control extreme groups demonstrated no significant differences in consumer behavior. **
Impulse Action, but not Impulse Plan, extreme groups significantly differ in consumer behavior, with high Impulse Action group showing high impulse consumer behavior. ***	Impulse Action, but not Impulse Plan, high/low groups demonstrate differences in consumer behavior, and replicated findings in study one. ***
	Both Working Memory and Inhibitory control high/low groups demonstrated differences in Impulse Action but not Impulse Plan. **
Conscientiousness extreme groups demonstrate differences in consumer behavior. **	Conscientiousness nor any other personality measures, high/low groups showed no differences in consumer behavior. **

Note: *** reflects findings that replicated across studies; ** indicates failures to replicate; * indicates results that are unique to one study.

The first question asked in this dissertation was, “What is the relation between personality, impulsive consumer behavior, and executive function, as measured by the Executive Function Index, a self-report measure?” Findings from these studies offer the following answers to this question. First, of the Executive Function Index subscales, the EFI Organization appears

to be most related to impulsive consumer behavior. Higher EFI Organization scores were associated with lower spending behavior, lower financial risk taking, lower credit-card misuse, and opportunity seeking, and with higher value seeking in Study 1. Similarly, extreme groups formed on the basis of EFI Organization score differed significantly in consumer behavior. Additionally, EFI Impulse Control appeared to be related to consumer behavior in lower spending, financial risk taking, credit card misuse, and opportunity seeking, and higher value seeking in Study 1. The EFI Organization subscale was also found to be related to impulsive consumer behavior, as evidenced by the Purchasing Task in Study 2. Individuals who were higher in EFI Organization in Study 2 demonstrated less impulsive consumer behavior in the purchasing task by purchasing less times and spending less money. These results suggest that the EFI Organization and Impulse Control subscales, as measures of executive function, indicate executive function as having a role in consumer behavior. The fact that Impulse Control is not related to the measures of consumer behavior in Study 2 may be understood by the specific items in the measure. The items for EFI Organization focus on remembering, maintaining, and updating a sequence, monitoring, not losing track of a process, etc.; whereas the items for Impulse Control focused more on control of inappropriate behaviors (i.e., sexual advances). Thus, the Study 2 Purchasing task could reflect more of the behaviors measured in the EFI Organization items than in EFI Impulse Control. This impact appears to replicate previous studies that suggest better executive function informs consumer decision making through self-regulation supported by updating and monitoring. In addition, the same two subscales are also related to a type of impulsivity (Impulse Action) that is itself associated with impulsive consumer behavior whereas personality measures, namely conscientiousness, was related to Impulse Plan, a type of impulsivity not associated to consumer behavior.

The only relationship identified between personality and consumer behavior is the high/low groups differences in Conscientiousness in consumer behavior in Study 1A and Study 1B. The relationship between Conscientiousness and consumer behavior was not replicated in Study 2. No additional findings from this study suggested relations between personality measures and impulsive consumer behavior (i.e., correlations were significant, but very small); however, personality measures were significantly associated with the Executive Function Index subscales (Motivational Drive and Strategic Planning) that were themselves not related to consumer behavior. This finding supports Fleming, Heintzelman, and Bartholow's (2016) contention that the personality trait of conscientiousness is associated with mental set-shifting but not working memory (updating) or inhibitory control. The results, finding a relationship between conscientiousness and consumer behavior in Study 1A and Study 1B but not in Study 2, in addition to Fleming, et. al.'s (2016) finding, bolster the prediction that measures of cognitive flexibility are not associated with consumer behavior. It is interesting that the present findings from Study 2 were consistent with that prediction in that cognitive flexibility did not demonstrate any relationship with consumer behavior.

Thus, for the first goal, this study suggests that two subscales of the EFI, Organization and Impulse Control, have some relationship with consumer behavior, and that the other subscales of the EFI are more closely related to personality, as the other subscales show no relationship to consumer behavior.

For the second goal, the question was asked, "What is the relation between standard cognitive or behavioral assessments of executive function, personality, and consumer behavior? The findings from an investigation into the relationship between working memory and impulsivity provided some preliminary insight and support (albeit certainly not conclusive) for

Hinson, Witney, and Jameson's (2003) claim that impulsivity is mainly an adaptive behavior for low working memory, and trait impulsivity can be largely accounted for by individual differences in working memory capacity.

According to Friedman and Miyake (2017), common EF is representing, implementing, and maintaining goals. However, Engle (2018) and others have concluded that working memory capacity is also goal maintenance through controlled attention, as opposed to updating and integrating of information as measured by Nback and Corsi, used in this study. Thus, for this study, goals regarding financial health must be attended to, and working memory would be used for updating and integrating information, in addition to monitoring current financial state as it pertains to the goal of financial health. The ambiguous role of inhibitory control in this study, as associated with Impulse Action but not consumer behaviors, may actually offer support to this perspective of Common EF as inhibitory control for maintenance of goals. Inhibitory control can be seen as framework or scaffolding in which goals are perpetually secured regardless of incorporation or updating of new information. In Study 2's Purchasing Task, long term goal maintenance was not necessary for a hypothetical purchasing task. Within the context of Study 2, goals for the tasks as well as the survey purchasing outcomes would be to act in a financially responsible manner, particularly to remain within a budget and not spend money beyond their budget, but there were minimal to no distractions of classically-conditioned advertisements or other long-term distractions that compete for one's attention in daily life. There were also no significant consequences for not maintaining their goals, and for some individuals, the goal that was being represented and maintained most likely would have been to finish the task as soon as possible to receive their payment. Therefore, in this study, it is evident that executive function, as defined and modeled by Friedman and Miyake's (2017) current model, informs consumer

behavior. First, Common EF, or goal maintenance provides a backdrop matrix of goal-related information by which an individual then updates and monitors information against to evaluate the potential consequences of an action. The matrix of inhibition could possible bias perception to help maintain ongoing goals, and at a minimum make choices about what to buy and when to buy it easier. Working memory would update current state, but the decision at hand would be viewed through the lens of goal maintenance (i.e., what the participant was instructed to or trying to accomplish). For this current study, however, the purchasing task did not require goal maintenance in consumer decision making; that is, participants were not required to keep track of expenditures or to remain within a fixed budget. Thus, executive function component with the strongest relation to purchasing behavior was found to be working memory (mental updating) rather than inhibition (controlled attention to inhibit prepotent tendencies to spend in ways antithetical to the participant's goals).

Witney, Jameson, and Hinson (2003) demonstrated differences in relations between types of impulsivity and working memory capacity and inhibition. Although factor analysis determined two subtypes of impulsivity in this study, as opposed to the three subtypes listed in Witney, et al.'s work, the current findings substantiate the Witney and collaborators' results that types of impulsivity do, in fact, relate to some of Miyake and Friedman's factors of executive function. Like Witney, et al.'s findings, the present study suggested that inhibitory control is related to motor impulsivity, as reflected in an impulse action measure. However, unlike Witney, et. al.'s findings, no factors of executive function (working memory, inhibitory control, or cognitive flexibility) were related to Impulse Plan in this study. Rather, only the personality trait of conscientiousness demonstrated a strong relation with Impulse Plan.

There was no significant relationship between Inhibitory Control (as measured by behavioral measures of Stroop, Stop Signal and Go/No-Go, and defined as inhibiting responses to nonrelevant stimuli) and Impulse Control (as measured by EFI IC, with items referencing inhibition of inappropriate behavior) or impulsive consumer behavior (defined in Study 2 as more purchases and more money spent). In fact, the stronger of these relationships identified in the current study was between Inhibitory Control and Impulse Action (as measured by BIS-8, with items referencing motor control). These results suggest that the measures of Inhibitory Control and Impulse Control do not reflect the same cognitive processes, despite the similarity of their names and what would seem to be overlap in their meanings (i.e., stopping responses to irrelevant or unfavorable stimuli). However, the present results provide little insight into what these indices *actually* measure, and which seems most likely to be useful in understanding the role of inhibitory control in consumer behavior.

The results for this study reflect Barratt's (2004) proposal that working memory capacity contributes to self-regulation within the dual-process model. Barratt discussed three mechanisms through which individual differences in controlled attention manifest in variations of self-control. First, working memory capacity is associated with tolerance of ambiguity. Tolerance of ambiguity would reflect the ability to monitor and simultaneously hold conflicting information. Barratt (2001) also suggested that uncertainty places cognitive load on an individual, thus making correct evaluation of future choice while holding or maintaining evaluation of the immediate option more difficult. Individuals with high capacity for working memory would therefore be at an advantage over low WMC individuals in resolving ambiguous and uncertain situations. Within the present study, one may question whether the requirement to monitor and update amounts of purchase creates ambiguity and uncertainty for the individual. If he or she is

unable to predict (as they were) how many purchasing questions, in what order, or what the potential outcome of the purchasing task would be (e.g., if there were real-world consequence to responses in the purchasing task), the participant could be cognitively loaded. In addition, the time limit of one hour for Study 2 could load a participant as well. This cognitive load would certainly affect outcomes of individuals with high versus low working memory, as Barratt suggested.

Second, Barratt (2001) argued that working memory capacity assists an individual's ability to resist attentional capture and thus allows the person to maintain goal-oriented control. Within this dissertation, individuals with the ability to maintain the budget and monitor and update how closely their running purchases amounted to that total were the individuals who scored higher in working memory. This is evidenced by the significant differences in the high and low working memory group comparisons on purchasing behavior.

Third, Barratt suggested that working memory capacity may influence an individual's ability to suppress classically-conditioned affective associations not relevant or optimal at that time. The present study does not directly support or negate this claim. However, within the two survey studies, individuals with high scores in the EFI Organization and EFI Impulse Control subscales demonstrated real-life decisions that would include resisting attractive advertisement and attractive get-rich-quick opportunities by scoring lower in spending behavior and opportunity seeking, and higher in control over risky financial behaviors, as well as overall impulsive consumer behavior. Although this study does not directly test the validity of Barratt's claim, the outcomes do rely on overriding impulses and resisting attractive advertisement. Therefore, the differences between high and low executive function groups in the measured outcomes may substantiate Barratt's claim.

Regarding Hofmann, Gschwendner, Friese, Wiers, and Schmit's (2008) claim that working memory capacity moderates the relation between automatic and controlled precursors and behaviors, the current study offers support. In particular, the second study demonstrates individuals with higher working memory were less likely to purchase impulsively or to extend beyond their stated budget. Hofmann et. al. could explain this result by suggesting that individuals with lower working memory capacity were more inclined to succumb to automatic impulses, such as the emotional appeal of getting the newer, bigger, and fancier option, of purchase.

For the third goal, the question was asked, "How does the Executive Function Index relate to Executive Function, as measured by traditional cognitive assessments. With regard to the Executive Function Index (EFI) and its validity, the results suggest that some subscales of the EFI do indeed relate, although not strongly, with the behavioral measures known to measure cognitive flexibility, inhibitory control, and working memory capacity. Two subscales of the EFI (Impulse control and Organization) were significantly, but weakly (i.e., accounting for less than five percent of the variability), correlated with measures of all three of Miyake and Friedman's (2012) components: updating, cognitive flexibility/shifting, and inhibitory control. However, although these two EFI subscales correlated with behavioral assessments of executive function, the remaining subscales of the EFI were not significantly related to any cognitive behavioral assessments of executive function. The EFI subscales of Motivational Drive, Empathy, and Strategic Planning seem not to measure or relate to executive functions found in the three cognitive components in the Unity/Diversity model. However, two of these three EFI subscales, Motivational Drive and Strategic Planning, did correlate somewhat strongly moderately well with personality traits.

A potential explanation for the findings is that some (perhaps all, as even Org and IC had largest correlations with some of the Big Five, as is discussed below) of Spinella's EFI were more strongly correlated with personality measures instead of executive functions could be grounded in findings by Murdock, Oddi, and Bridgett (2013) that some executive functions could be significantly related to personality. For example, these authors found working memory capacity to be significantly related to neuroticism and to openness. That is, individuals with high working memory scores were more open to experience, more extroverted, and less neurotic. Whereas findings such as these demonstrate potential relationships between personality and executive functions, this current study only found significant correlations between the self-report survey results, not the behavioral indicators of executive functioning. Thus, it is just as plausible that the relationships could be accounted for by similarity in assessment delivery. That is, common method variance may inflate correlations; thus, it may be expected that the measures of self-report survey may appear to be more closely related with each other than the behavioral measures and survey scales.

One can infer that the EFI not only measures executive functions but personality traits as well, therefore suggesting either that the EFI is not a valid measure of executive function or that executive functions and personality traits overlap. Or it may be inferred that the state of mind or state of personality, as personality can have slight fluctuations, the individual is experiencing influences self-report measures of anything, including executive function. The more parsimonious answer would be the EFI lacks validity as a 'pure' measure of executive function, as a substantial amount of research would be needed to verify the claim that executive function and personality traits could inform or account for each other.

Current research does suggest, however, that there is some relation between personality, as measured by the Big Five, and cognition. For example, Soubelet & Salthouse (2010) identified some strong relations between personality and cognition across life span. In particular, higher Openness was positively correlated and associated with four cognitive ability factors: fluid intelligence, crystallized intelligence, episodic memory, and perceptual speed. They also found that higher Extraversion was associated with lower levels of fluid and crystalized intelligence. Unsworth, et. al. (2009) found Neuroticism was weakly and negatively related to fluid intelligence; however, Openness was not related to fluid intelligence, nor were Agreeableness nor Conscientiousness related to any measures of executive functions (Flanker, Ospan, Antisaccade, Raven, Letter fluency). Buchanan (2016) tested for correlations between personality measures, self-report executive function (Webexe; Buchanan, 2010), and standard cognitive assessments (Trail-Making, Digit Span, and Semantic Fluency). Buchanan identified in three studies some strong relationships between self-reported executive dysfunction or problems and Neuroticism and low Conscientiousness, with moderate to strong effects. However, Openness was not related to any measures of executive function. Thus, existing results regarding the relationship between personality and executive function are somewhat inconsistent. The current literature is inadequate to make claims, and additional research is needed.

In this current study, some relations between personality and self-report measures of executive function were similarly identified, although the majority of these correlations were weak to moderate. In particular, Motivational Drive was related to Extraversion and Openness, and Strategic planning was related to Conscientiousness. What is most interesting, however, is that the relationships were found with executive function self- report measures not correlated with standard cognitive assessments. Thus, the conclusion may possibly follow that the subscales

of the EFI Motivational Drive and Strategic Planning failed to measure executive function, and thus that there are no executive functions truly measured with the EFI. Rather, it appears that the EFI measures one's attitudes or beliefs about one's executive functions.

The result from Study 2 indicated the following: Only the EFI subscales of organization and impulse control demonstrated relations with standard cognitive assessments that were selected to reflect components within Miyake and Friedman's (2012) model. In particular, these two subscales seemed to be most related to working memory (updating) and maybe inhibitory control (common EF), albeit to a lesser degree. For example, EFI Organization items included references to consolidation and updating information and maintaining a sequence of information whereas EFI Impulse Control items reflected real-world impulsivity like inappropriate sexual advances and swearing. These items, of all the EFI agreement statements, are most likely to reflect behavior associated with working memory and impulse control. The remaining subscales of the EFI were not related to cognitive assessments of Miyake and Friedman's Unity/Diversity Model but rather measures of personality. In addition, working memory and the Executive Function Index subscale of organization demonstrated overlap in the relation with consumer behavior, with working memory demonstrating stronger effects. These findings challenge Spinella's (2004) claim that all of the factors in his index, Strategic Planning, Organization, Motivational Drive, Empathy, and Impulse Control, measure factors of executive function, and should be related to cognitive assessments of executive function. Also, these findings challenge Spinella's assertion that the correlation of the Executive Function Index to other self-report measures previously validated with behavioral measures validate the EFI. Although the relations observed here between EFI subscales and standard cognitive behavioral tasks were not strong, the two subscales of Impulse Control and Organization did indicate some relationship with

executive function, as well as with impulsive consumer behavior. In particular, the two subscales of Impulse Control and Organization replicated the same relationship as working memory and impulsive consumer behavior, although more weakly. Thus, the findings of this study suggest the EFI needs additional work to become a valid self-report measure of executive function.

It appears from these studies that only one of the components of Miyake and Friedman's (2012) model, namely working memory, directly informs impulsive consumer behavior. In addition, personality is not associated with impulsive consumer behavior, nor does it interact with working memory with regards to impulsive consumer behavior. Finally, there is some evidence that inhibitory control offers supports or is a type of scaffolding for the effects of working memory within impulsive consumer behavior.

With regards to the EFI and impulsive consumer behavior, both parts of Study 1, with a total of over 12,000 participants, revealed a significant relationship between the two EFI subscales of Impulse Control and Organization and consumer behavior. Part B of Study One replicated findings in Part A that individual differences in Impulse Control and Organization were in fact related to impulsive consumer behavior. These two subscales were also the only subscales significantly related to behavioral measures of executive function. A strong inference may thus be made that executive function, as measured by two subscales of the Executive Function Index, is indeed related to impulsivity within consumer behavior. However, in Study 2, EFI Organization was the only subscale to be related to consumer behavior. Also, the relations between personality measures and EFI subscales were stronger than the relations between EFI subscales and behavioral measures of executive function. In addition, of the behavioral measures for components of executive function, working memory was found to demonstrate an association with consumer behavior. Thus, a potential inference from these studies may be that EFI

Organization measures (or perhaps requires) working memory. This inference would explain why groups formed on the basis of high/low working memory (Nback and Corsi) and EFI Organization similarly differed significantly on measures of consumer behavior.

In conclusion, this study confirms that executive function plays a role within consumer decision making and consumer behavior. In both studies, executive function, as measured first by a self-report measure and then secondly by standard cognitive assessments, was inversely related with impulsive consumer behavior. Specifically, working memory demonstrated the strongest relationship with impulsive consumer behavior.

One limitation of this project would be the need to parse out individuals in the second study who did not engage and respond honestly during the study. Because the methodology of this study was an online survey, participant engagement could not be monitored. Although the number of participants not fully engaged in each task should be minimal in this study, as responses from individuals who responded under a specific time (seven minutes) were removed from the study, additional insight into participant engagement could be helpful. A recording of individual task and question response times would be helpful to understand whether any immediate yes/no answers to each individual question simply reflected disengagement (i.e., participants just clicking without reading to end the survey sooner).

A second limitation is the question of reality. The question must arise that individuals may respond in a different manner if their real money is at stake. For example, one must question whether chronic or acute financial distress could load an individual. This load, per Hinson et. al. (2003), could in turn affect consumer behavior by disallowing the individual the opportunity to evaluate long-term reward as well as short-term rewards correctly. The purchasing questions generated for Study 2 were designed to maximize the participants' experience of making real-life

purchases; nevertheless, it remains to be determined whether the relations observed here would generalize to decision-making in a real-life phone purchase, for example.

In addition, as part the issue with real-world experience, a limitation on Study 2 is the failure of necessity for goal maintenance. Participants were asked to name their hypothetical budget but were given no instructions or reward for maintaining the budget. Adding instructions and an incentive to engage a goal of remaining under budget may offer enough incentive to perform goal maintenance, and in doing so, engage common EF in participants.

To conclude, the study identified working memory as the component of executive function that informs purchasing behavior. Higher working memory is associated with consumer behavior outcomes associated with self-regulation, such as less spending, more value seeking, and staying within a budget. Additionally, this study tested a self-report measure of executive function and found that while one subscale was related to some consumer behavior and minimally related to behavior measures of working memory, the majority of it to be more closely associated with personality.

To further the findings of this study, additional studies may contain the following: First, a follow-up study using methodology that replicates real-life spending scenarios would address the question of whether or not hypothetical money is handled differently, thus affecting consumer decision making. In this scenario, a participant would receive a specific spending amount, and a purchase to be made. Upsells would be given, with the understanding the amount not spent is kept for future purchases of their choice. Additionally, with the correct technology, a study in which real-world purchase options in real-time on a participants' phone would address these limitations.

Second, a follow-up study should address the need for practical means to improve consumer decisions. Multiple studies have resulted in negative or inconclusive results for Working Memory Capacity training (Shipstead, Redick, Engel, 2010); thus, countering impulsive spending with memory training is not suggestable. Rather, training individuals in long-term goal maintenance may be a successful way to combat impulsive spending. In this model, inhibitory control, or common EF should be investigated as a preemptive ability to maintain a system of goals in spending choices. In other words, if an individual is trained to preempt a choice, by biasing perception of environment or by simply training a habitual negative response with qualifications, with a "no" or an agreement of choices to be made for spending, the choice for yes is then only considered or contemplated within parameters. This training may then minimize the need for larger amounts of working memory resources to evaluate and compare smaller/sooner, bigger/later choices, or with load of emotional appeal. The choice is made prior to consideration or emotionally appealing information. In this additional study, types of trainings may be considered and tested. In particular, asking individuals to journal, pray, or contemplate their particular financial goals prior to making a financial choice may be an effective means of pre-empting impact of emotional appeal in advertising through time delay. In addition, journaling, contemplating, or prayer may also serve as effective means of rehearsal of goals and slow down impulsive decision making.

A third follow-up study should address the Executive Function Index. In particular, another study should work to modify the EFI to correlate successfully with cognitive measures of executive function. This study should also seek explicitly to test whether the EFI measures individual's *beliefs* about their executive function rather than EF itself. In other words, a study should seek to parse out the influence an individual's beliefs or perspective of their EF

performance from actual objective knowledge of personal performance in executive function. It is possible, of course, that the EFI accurately captures what participants understand about EF and believe with respect to their own strengths and weaknesses, and still for those beliefs to be inaccurate (as, for example, when one's confidence is poorly calibrated to one's accuracy). In this follow-up study to explicate the relation of EFI and personality, additional self-report measures that are unrelated to executive function should be included. By examining those correlations, we may determine the degree to which the relation between EF and personality reflect method variance (e.g., the manifest inter-correlation of all self-report measures) or if it is something more meaningful, something that informs the literature about the influence of personality on EF, and vice versa.

REFERENCES

Ainslie, G. (1975). Specious reward: A behavioral theory of impulsiveness and impulse control. *Psychological Bulletin, 82*(4), 463-496.

Alessi, S. M., & Petry, N. M. (2003). Pathological gambling severity is associated with impulsivity in delay discounting procedure. *Behavioural Processes, 64*(3), 345-354.

Alvarez, J. A., & Emory, E. (2006). Executive function and the frontal lobes: A meta-analytic review. *Neuropsychology Review, 16*(1), 17-42.

Applebaum, W. (1951). Studying customer behavior in retail stores. *Journal of Marketing, 16*(2), 172-178.

Army, U. S. (1944). *Army individual test battery. Manual of directions and scoring.* Washington DC: War Department Adjunct General's Office.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. *Psychology of Learning and Motivation, 2,* 89-195.

Baddeley, A. (1986). *Working memory.* Oxford, UK: Oxford University Press.

Baddeley, A. (1992). Working memory and conscious awareness. In A. F. Collins, S. E. Gathercole, M. A. Conway, & P. E. Morris (Eds.), *Theories of memory* (pp. 11-28) Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

Baddeley, A. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences, 4*(11), 417-423.

Baddeley, A. (2003). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience, 4*(10), 829-839.

Baddeley, A. D., & Hitch, G. (1974). Working memory. *Psychology of Learning and Motivation, 8*, 47-89.

Banich, M. T. (2009). Executive function: The search for an integrated account. *Current Directions in Psychological Science, 18*(2), 89-94.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin, 121*(1), 65–94.

Barkley, R. A., & Fischer, M. (2011). Predicting impairment in major life activities and occupational functioning in hyperactive children as adults: Self-reported executive function (EF) deficits versus EF tests. *Developmental Neuropsychology, 36*(2), 137-161.

Barratt, E. S. (1959). Anxiety and impulsiveness related to psychomotor efficiency. *Perceptual and Motor Skills, 9*(3), 191-198.

Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin, 130*(4), 553-573.

Barrouillet, P. (1996). Transitive inferences from set-inclusion relations and working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*(6), 1408-1422.

Baumeister, R. F. (2002). Ego depletion and self-control failure: An energy model of the self's executive function. *Self and Identity, 1*(2), 129-136.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*(5), 1252-1265.

Baumeister, R. F., & Heatherton, T. F. (1996). Self-regulation failure: An overview. *Psychological Inquiry, 7*(1), 1-15.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego, CA, US: Academic Press.

Bechara, A., Damasio A. R., Damasio H., Anderson S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition, 50*, 7-15.

Beran, M. J., Evans, T. A., Paglieri, F., McIntyre, J. M., Addessi, E., & Hopkins, W. D. (2014). Chimpanzees (Pan troglodytes) can wait, when they choose to: A study with the hybrid delay task. *Animal Cognition, 17*(2), 197-205.

Bond, A. J., Verheyden, S. L., Wingrove, J., & Curran, H. V. (2004). Angry cognitive bias, trait aggression and impulsivity in substance users. *Psychopharmacology, 171*(3), 331-339.

Borkowski, J. G., & Burke, J. E. (1996). Theories, models, and measurements of executive functioning: An information processing perspective. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention, memory, and executive function* (pp. 235-261). Baltimore, MD, US: Paul H Brookes Publishing.

Borkowski, J., Chan, L. K. S., & Muthukrishna, N. (2000) A process-oriented model of metacognition: Links between motivation and executive functioning. In G. Schraw & J. C. Impara (Eds.), *Issues in the measurement of metacognition.* Lincoln, NE: Buros Institute of Mental Measurements.

Borkowski, J., & Muthukrishna, N. (1992). Moving metacognition into the classroom: "Working models" and effective strategy teaching. In M. Pressley, K. R. Harris, & J. T. Guthrie (Eds.), *Promoting academic competence and literacy in school* (pp. 477-501). San Diego, CA, US: Academic Press.

Broadbent, D. E. (1953). Noise, paced performance and vigilance tasks. *British Journal of Psychology, 44*(4), 295-303.

Broadway, J. M., & Engle, R. W. (2010). Validating running memory span: Measurement of working memory capacity and links with fluid intelligence. *Behavior Research Methods, 42*, 563-570. doi:10.3758/BRM.42.2.563

Brown, T. E. (2009). ADD/ADHD and impaired executive function in clinical practice. *Current Attention Disorders Reports, 1*(1), 37-41.

Buchanan, T., Heffernan, T. M., Parrott, A. C., Ling, J., Rodgers, J., & Scholey, A. B. (2010). A short self-report measure of problems with executive function suitable for administration via the Internet. *Behavior Research Methods, 42*(3), 709-714.

Buchanan, T. (2016). Self-report measures of executive function problems correlate with personality, not performance-based executive function measures, in nonclinical samples. *Psychological Assessment, 28*(4), 372.

Calvillo, D. P. (2012). Working memory and the memory distortion component of hindsight bias. *Memory, 20*(8), 891-898.

Carvalho, J. O., Ready, R. E., Malloy, P., & Grace, J. (2013). Confirmatory factor analysis of the Frontal Systems Behavior Scale (FrSBe). *Assessment, 20*(5), 632-641.

Carver, C. S. (2005). Impulse and constraint: Perspectives from personality psychology, convergence with theory in other areas, and potential for integration. *Personality and Social Psychology Review, 9*(4), 312-333.

Cattell, R. B. (1943). The description of personality: Basic traits resolved into clusters. *The Journal of Abnormal and Social Psychology, 38*(4), 476-506.

Clover, V. T. (1950). Relative importance of impulse-buying in retail stores. *Journal of Marketing, 15*(1), 66-70.

Coutlee, C. G., Politzer, C. S., Hoyle, R. H., & Huettel, S. A. (2014). An Abbreviated Impulsiveness Scale constructed through confirmatory factor analysis of the Barratt Impulsiveness Scale Version 11. *Archives of Scientific Psychology, 2*(1), 1.

Cowan, N. (1999). An embedded-processes model of working memory. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control* (pp. 62-101). New York, NY: Cambridge University Press.

Cowan, N. (2012). *Working memory capacity*. New York, NY, US: Psychology Press.

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior, 19*(4), 450-466.

Daneman, M., & Carpenter, P. A. (1983). Individual differences in integrating information between and within sentences. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9*(4), 561-584.

Daneman, M., & Green, I. (1986). Individual differences in comprehending and producing words in context. *Journal of Memory and Language, 25*(1), 1-18.

Daigneault, S., Braun, C. M. J., & Whitaker, H. A. (1992). An empirical test of two opposing theoretical models of prefrontal function. *Brain and Cognition, 19*(1), 48-71.

Dawson, P., & Guare, R. (2010). *Executive skills in children and adolescents: A practical guide to assessment and intervention.* New York, NY, US: Guilford Press.

De Houwer, J., Thomas, S., & Baeyens, F. (2001). Association learning of likes and dislikes: A review of 25 years of research on human evaluative conditioning. *Psychological Bulletin, 127*(6), 853.

Denckla, M. B. (1994). Measurement of executive function. In G. R. Lyon (Ed.), *Frames of reference for the assessment of learning disabilities: New views on measurement issues* (pp. 117-142). Baltimore, MD, US: Paul H Brookes Publishing.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64,* 135-168.

DiClemente, D. F., & Hantula, D. A. (2003). Applied behavioral economics and consumer choice. *Journal of Economic Psychology, 24*(5), 589-602.

Dolan, S. L., Bechara, A., & Nathan, P. E. (2008). Executive dysfunction as a risk marker for substance abuse: The role of impulsive personality traits. *Behavioral Sciences & the Law, 26*(6), 799-822.

Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science, 11*(1), 19-23.

Engle, R. W., Carullo, J. J., & Collins, K. W. (1991). Individual differences in working memory for comprehension and following directions. *The Journal of Educational Research, 84*(5), 253-262.

Engle, R. W., Kane, M. J., & Tuholski, S. W. (1999). Individual differences in working memory capacity and what they tell us about controlled attention, general fluid intelligence, and functions of the prefrontal cortex. In A. Miyake & P. Shah (Eds.), *Models of working memory. Mechanisms of active maintenance and control* (pp. 102-134). New York, NY: Cambridge University Press.

Epstein, S. (1998). Cognitive-experiential self-theory. In D. F. Barone, M. Hersen, & V. B. Van Hasselt (Eds.), *The Plenum series in social/clinical psychology. Advanced personality* (pp. 211-238). New York, NY, US: Plenum Press.

Eysenck, H. J. (1947). *Dimensions of personality*. New York: Praeger.

Eysenck, H. J. (1953). *The structure of human personality*. New York, NY, US: Methuen.

Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the Eysenck Personality Questionnaire (junior and adult)*. Kent, UK: Hodder & Stoghton.

Faber, R. J., & O'Guinn, T. (1992). A clinical screener for compulsive buying. *Journal of Consumer Research, 19*(3), 459-460.

Fan, J., McCandliss, B. D., Sommer, T., Raz, A., & Posner, M. I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience, 14*(3), 340-347.

Fernández, A. M., Dufey, M., & Kramp, U. (2011). Testing the psychometric properties of the Interpersonal Reactivity Index (IRI) in Chile. *European Journal of Psychological Assessment, 27*(3), 179-185.

Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index.* Ottawa, ON: Canadian Centre on Substance Abuse.

Finn, P. R., Justus, A., Mazas, C., & Steinmetz, J. E. (1999). Working memory, executive processes and the effects of alcohol on Go/No-Go learning: Testing a model of behavioral regulation and impulsivity. *Psychopharmacology, 146*(4), 465-472.

Fleming, K. A., Heintzelman, S. J., & Bartholow, B. D. (2016). Specifying associations between conscientiousness and executive functioning: Mental set shifting, not prepotent response inhibition or working memory updating. *Journal of personality, 84*(3), 348-360.

Galton, F. (1949). The measurement of character. In D. Wayne (Ed.), *Readings in general psychology* (pp. 435-444). New York, NY, US: Prentice-Hall, Inc.

Giancola, P. R., & Tarter, R. E. (1999). Executive cognitive functioning and risk for substance abuse. *Psychological Science, 10*(3), 203-205.

Gilet, A. L., Mella, N., Studer, J., Grühn, D., & Labouvie-Vief, G. (2013). Assessing dispositional empathy in adults: A French validation of the Interpersonal Reactivity Index (IRI). *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement, 45*(1), 42.

Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist, 48*(1), 26-34.

Goldstein, S., Naglieri, J. A., Princiotta, D., & Otero, T. M., eds. (2014). Introduction: A history of executive functioning as a theoretical and clinical construct. In *Handbook of Executive Functioning* (pp. 3-12). New York: Springer.

Gorn, G. J. (1982). The effects of music in advertising on choice behavior: A classical conditioning approach. *The Journal of Marketing, 46*(1), 94-101.

Gosling, S. D., Rentfrow, P. J., Swann, Jr. W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37,* 504–528.

Gullone, E., & Moore, S. (2000). Adolescent risk taking and the five-factor model of personality. *Journal of Adolescence, 23*(4), 393-407. doi:10.1006/jado.2000.0327

Halperin, J. M., Newcorn, J. H., Sharma, V., Healey, J. M., Wolf, L. E., Pascualvaca, D. M., & Schwartz, S. (1990). Inattentive and noninattentive ADHD children: Do they constitute a unitary group? *Journal of Abnormal Child Psychology, 18*(4), 437-449.

Hamilton, K. R., Mitchell, M. R., Wing, V. C., Balodis, I. M., Bickel, W. K., Fillmore, M., ... & Mathias, C. W. (2015). Choice impulsivity: Definitions, measurement issues, and clinical implications. *Personality Disorders: Theory, Research, and Treatment, 6*(2), 182.

Hayes, S. C., Gifford, E. V., & Ruckstuhl Jr, L. E. (1996). Relational frame theory and executive function: A behavioral approach. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention,*

memory, and executive function (pp. 279-305). Baltimore, MD, US: Paul H. Brookes Publishing.

Heaton, R. K., Chelune, G. J., Curtiss, G., Kay, G. G., & Talley, J. L. (1993). *Wisconsin card sorting test manual.* Psychological Assessment Resources.

Helmers, K. F., Young, S. N., & Pihl, R. O. (1995). Assessment of measures of impulsivity in healthy male volunteers. *Personality and Individual Differences, 19*(6), 927-935.

Hinson, J. M., Jameson, T. L., & Whitney, P. (2003). Impulsive decision making and working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 29*(2), 298-306.

Hoaken, P. N., Shaughnessy, V. K., & Pihl, R. O. (2003). Executive cognitive functioning and aggression: Is it an issue of impulsivity? *Aggressive Behavior, 29*(1), 15-30.

Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology, 43*(3), 497-504.

Hofmann, W., Gschwendner, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behavior: Toward an individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology, 95*(4), 962-967.

Hoptman, M. J., Volavka, J., Johnson, G., Weiss, E., Bilder, R. M., & Lim, K. O. (2002). Frontal white matter microstructure, aggression, and impulsivity in men with schizophrenia: A preliminary study. *Biological Psychiatry, 52*(1), 9-14.

Iaboni, F., Douglas, V. I., & Baker, A. G. (1995). Effects of reward and response costs on inhibition in ADHD children. *Journal of Abnormal Psychology, 104*(1), 232-240.

Isen, J. D., Sparks, J. C., & Iacono, W. G. (2014). Predictive validity of delay discounting behavior in adolescence: A longitudinal twin study. *Experimental and Clinical Psychopharmacology, 22*(5), 434-443.

James, W. (1890). *The principles of psychology*. New York, NY, US: Henry Holt & Company.

Jansson-Boyd, C. V. (2010). *Consumer psychology.* New York, NY: Open University Press

Jones-Gotman, M., & Milner, B. (1977). Design fluency: The invention of nonsense drawings after focal cortical lesions. *Neuropsychologia, 15*, 653-674.

Kane, M. J., Bleckley, M. K., Conway, A. R., & Engle, R. W. (2001). A controlled-attention view of working-memory capacity. *Journal of Experimental Psychology: General, 130*(2), 169-183.

Keil, K., & Kaszniak, A. W. (2002). Examining executive function in individuals with brain injury: A review. *Aphasiology, 16*(3), 305-335.

Kiewra, K. A., & Benton, S. L. (1988). The relationship between information-processing ability and notetaking. *Contemporary educational psychology, 13*(1), 33-44.

King, J., & Just, M. A. (1991). Individual differences in syntactic processing: The role of working memory. *Journal of Memory and Language*, *30*(5), 580-602.

Kleider, H. M., Parrott, D. J. and King, T. Z. (2010). Shooting behavior: How working memory and negative emotionality influence police officer shoot decisions. *Applied Cognitive Psychology*, *24*, 707–717. doi:10.1002/acp.1580

Kuester, S. (2012). *MKT 301: Strategic marketing & marketing in specific industry contexts.* Mannheim, Germany: University of Mannheim.

Lane, S. D., Moeller, F. G., Steinberg, J. L., Buzby, M., & Kosten, T. R. (2007). Performance of cocaine dependent individuals and controls on a response inhibition task with varying levels of difficulty. *The American Journal of Drug and Alcohol Abuse, 33*(5), 717-726.

Latzman, R. D., & Markon, K. E. (2009). The factor structure and age-related factorial invariance of the Delis–Kaplan Executive Function System (D-KEFS). *Assessment, 17*(2), 172-184.

Levine, L. E., Waite, B. M., & Bowman, L. L. (2007). Electronic media use, reading, and academic distractibility in college youth. *CyberPsychology & Behavior, 10*(4), 560-566.

Lezak, M. D., Howieson, D. B., & Loring, D. W. (1995). Executive functions and motor performance. *Neuropsychological Assessment, 3*, 650-685.

Logan, G. D., Schachar, R. J., & Tannock, R. (1997). Impulsivity and inhibitory control. *Psychological Science, 8*(1), 60-64.

Logie, R. H., Gilhooly, K. J., & Wynn, V. (1994). Counting on working memory in arithmetic problem solving. *Memory & Cognition, 22*(4), 395-410.

Luria, A. R. (1966). *Higher cortical functions in man*. London: Tavistock.

Malloy-Diniz, L., Fuentes, D., Leite, W. B., Correa, H., & Bechara, A. (2007). Impulsive behavior in adults with attention deficit/hyperactivity disorder: Characterization of attentional, motor and cognitive impulsiveness. *Journal of the International Neuropsychological Society, 13*(04), 693-698.

Martin, L. E., & Potts, G. F. (2004). Reward sensitivity in impulsivity. *Neuroreport, 15*(9), 1519-1522.

McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*(1), 81.

McSweeney, F. K., & Bierley, C. (1984). Recent developments in classical conditioning. *Journal of Consumer Research, 11*(2), 619-631.

Miley, W. M., & Spinella, M. (2006). Correlations among measures of executive function and positive psychological attributes in college students. *The Journal of General Psychology, 133*(2), 175-182.

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience, 24*(1), 167-202.

Miller, G. A., Galanter, E., & Pribram, K. H. (1960). *Plans and the structure of behavior*. New York, NY: Henry Holt and Company.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49-100.

Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science, 21*(1), 8-14. doi:10.1177/0963721411429458

Moeller, F. G. (2012). Historical perspectives on impulsivity and impulse control disorders. In J. Grant & M. Potenza (Eds.), *Handbook of impulse control disorders* (pp. 11-21). New York, NY, US: Oxford University Press.

Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry, 158*(11), 1783-1793.

Morrison, A. B., & Chein, J. M. (2011). Does working memory training work? The promise and challenges of enhancing cognition by training working memory. *Psychonomic Bulletin & Review, 18*(1), 46-60.

Mowen, J. C. (2000). *The 3M model of motivation and personality: Theory and empirical applications to consumer behavior*. New York, NY, US: Springer Science & Business Media.

Mowrer, O. H., & Ullman, A. D. (1945). Time as a determinant in integrative learning. *Psychological Review, 52*(2), 61-90.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74*(3), 774-789.

Murdock, K. W., Oddi, K. B., & Bridgett, D. J. (2013). Cognitive correlates of personality: Links between executive functioning and the Big Five personality traits. *Journal of Individual Differences, 34*(2), 97-104. Doi:10.1027/1614-0001/a000104

Meyers, L., Gamst, G., & Guarino, A. (2013). *Applied multivariate research: Design and interpretation*. Los Angeles, CA: Sage Publications, Inc.

Niemeier, J. P., Perrin, P. B., Holcomb, M. G., Nersessova, K. S., & Rolston, C. D. (2013). Factor structure, reliability, and validity of the Frontal Systems Behavior Scale (FrSBe) in an acute traumatic brain injury population. *Rehabilitation Psychology, 58*(1), 51-63.

Nesbitt, Saul (1959). Today's housewives plan menus as they shop. Nesbitt Associates Release, 2-3.

Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology, 95*(3), 252.

Norman, D. A., Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In D. L. Shapiro & G. Schwartz (Eds.), *Consciousness and self-regulation: Advances in research* (pp. 1-14). New York, NY, US: Plenum Press.

Nyhus, E. & Barcelo, F. (2009). The Wisconsin Card Sorting Test and the cognitive assessment of prefrontal executive functions: A critical update. *Brain and Cognition, 71*, 437-451.

Oberlin, B. G., & Grahame, N. J. (2009). High-alcohol preferring mice are more impulsive than low-alcohol preferring mice as measured in the delay discounting task. *Alcoholism: Clinical and Experimental Research, 33*(7), 1294-1303.

Omar, N. A., Sainz, M., Abdul, R. R., Che Wel, C. A., & Shah A. S. (2014). Compulsive buying and credit card misuse among credit card holders: The roles of self-esteem, materialism, impulsive buying and budget constraint. *Intangible Capital, 10*(1), 52-74. http://dx.doi.org/10.3926/ic.446

Patton, J. H., & Stanford, M. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology, 51*(6), 768-774.

Peake, P. K., Hebl, M., & Mischel, W. (2002). Strategic attention deployment for delay of gratification in working and waiting situations. *Developmental Psychology, 38*(2), 313-326.

Peluso, M. A. M., Hatch, J. P., Glahn, D. C., Monkul, E. S., Sanches, M., Najt, P., ... & Soares, J. C. (2007). Trait impulsivity in patients with mood disorders. *Journal of Affective Disorders, 100*(1), 227-231.

Pennington, B. F., Bennetto, L., McAleer, O., & Roberts Jr, R. J. (1996). Executive functions and working memory: Theoretical and measurement issues. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention, memory, and executive function* (pp. 327-348) Baltimore, MD, US: Paul H Brookes Publishing.

Petrides, M. (1985). Deficits on conditional associative-learning tasks after frontal-and temporal lobe lesions in man. *Neuropsychologia, 23*(5), 601-614.

Pirog, S. F., & Roberts, J. A. (2007). Personality and credit card misuse among college students: The mediating role of impulsiveness. *Journal of Marketing Theory and Practice, 15*(1), 65-77.

Piron, F. (1991). Defining impulse purchasing. In R. H. Holman & M. R. Solomon (Eds.), *Advances in Consumer Research* (pp. 509-514). Provo, UT: Association for Consumer Research.

Pliszka, S. R., Borcherding, S. H., Spratley, K., Leon, S., & Irick, S. (1997). Measuring inhibitory control in children. *Journal of Developmental & Behavioral Pediatrics, 18*(4), 254-259.

Posner, M. I., & Snyder, C. R. R. (1975). Facilitation and inhibition in the processing of signals. *Attention and Performance, 5*, 669-682.

Potts, G. F., George, M. R. M., Martin, L. E., & Barratt, E. S. (2006). Reduced punishment sensitivity in neural systems of behavior monitoring in impulsive individuals. *Neuroscience Letters, 397*(1), 130-134.

Rabin, L. A., Fogel, J., & Nutter-Upham, K. E. (2011). Academic procrastination in college students: The role of self-reported executive function. *Journal of Clinical and Experimental Neuropsychology, 33*(3), 344-357.

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*(1), 203-212.

Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences, 47*(8), 973-978.

Reitan, R. M. (1958). Validity of the Trail Making Test as an indicator of organic brain damage. *Perceptual and Motor Skills, 8*(3), 271-276.

Reitan, R. M., & Wolfson, D. (1995). Category test and trail making test as measures of frontal lobe functions. *The Clinical Neuropsychologist, 9*(1), 50-56.

Reynolds, B., & Schiffbauer, R. (2004). Measuring state changes in human delay discounting: an experiential discounting task. *Behavioural Processes, 67*(3), 343-356.

Richins, M. L. (2004). The material values scale: Measurement properties and development of a short form. *Journal of Consumer Research, 31*(1), 209-219.

Roberts, J. A. & Jones, E. (2001). Money attitudes, credit card use, and compulsive buying among American college students. *Journal of Consumer Affairs, 35*(2), 213-241.

Rodriguez, M. L., Mischel, W., & Shoda, Y. (1989). Cognitive person variables in the delay of gratification of older children at risk. *Journal of Personality and Social Psychology, 57*(2), 358-367.

Rodriguez-Jimenez, R., Avila, C., Jimenez-Arriero, M. A., Ponce, G., Monasor, R., Jimenez, M. E. E. A., ... & Palomo, T. (2006). Impulsivity and sustained attention in pathological gamblers: Influence of childhood ADHD history. *Journal of Gambling Studies, 22*(4), 451-461.

Rogers, R. D., & Monsell, S. (1995). Costs of a predictable switch between simple cognitive tasks. *Journal of Experimental Psychology: General, 124*(2), 207- 231.

Rook, D. W. (1987). The buying impulse. *Journal of Consumer Research, 14*(2), 189-199.

Romer, D., Betancourt, L., Giannetta, J. M., Brodsky, N. L., Farah, M., & Hurt, H. (2009). Executive cognitive functions and impulsivity as correlates of risk taking and problem behavior in preadolescents. *Neuropsychologia, 47*(13), 2916-2926.

Romer, D., Betancourt, L. M., Brodsky, N. L., Giannetta, J. M., Yang, W., & Hurt, H. (2011). Does adolescent risk taking imply weak executive function? A prospective study of relations between working memory performance, impulsivity, and risk taking in early adolescence. *Developmental Science, 14*(5), 1119-1133.

Rook, D. W., & Hoch, S. J. (1985). Consuming impulses. In E. C. Hirschman & M. B. Holbrook, *NA advances in consumer research,* (pp. 23-27). Provo, UT, US: Association for Consumer Research.

Rook, D. W., & Fisher, R. J. (1995). Normative influences on impulsive buying behavior. *Journal of Consumer Research, 22*(3), 305-313.

Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2004). Attentional control and self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 284-299). New York, NY, US: Guilford Press.

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84*(1), 1-66.

Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending and a general theory. *Psychological Review, 84*(2), 127-190.

Séguin, J. R., Boulerice, B., Harden, P. W., Tremblay, R. E., & Pihl, R. O. (1999). Executive functions and physical aggression after controlling for attention deficit hyperactivity disorder, general memory, and IQ. *Journal of Child Psychology and Psychiatry, 40*(8), 1197-1208.

Shallice, T., Burgess, P., Robertson, I. (1996). The domain of supervisory processes and temporal organisation of behaviour. *Philosophical Transactions of the Royal Society B, 351*(1346): 1405–1412. doi:10.1098/rstb.1996.0124.PMID8941952.

Shipstead, Z., Redick, T. S., & Engle, R. W. (2012). Is working memory training effective? *Psychological bulletin*, *138*(4), 628.

Siu, A. M., & Shek, D. T. (2005). Validation of the Interpersonal Reactivity Index in a Chinese context. *Research on Social Work Practice, 15*(2), 118-126.

Miley, W. M., & Spinella, M. (2006). Correlations among measures of executive function and positive psychological attributes in college students. *Journal of General Psychology, 133*(2), 175-182.

Sohlberg, M. M., & Mateer, C. A. (Eds.). (2001). *Cognitive rehabilitation: An integrative neuropsychological approach*. New York, NY, US: Guilford Press.

Soubelet, A., & Salthouse, T. A. (2011). Personality–cognition relations across adulthood. *Developmental psychology*, *47*(2), 303.

Spector, P. E. (2006). Method variance in organizational research: Truth or urban legend? *Organizational research methods*, *9*(2), 221-232.

Spinella, M. (2002). Correlations among behavioral measures of orbitofrontal function. *International Journal of Neuroscience, 112*(11), 1359-1369.

Spinella, M. (2002). Correlations between orbitofrontal dysfunction and tobacco smoking. *Addiction Biology, 7*(4), 381-384.

Spinella, M. (2005). Self-rated executive function: Development of the executive function index. *International Journal of Neuroscience, 115*(5), 649-667.

Spinella, M., Yang, B., & Lester, D. (2004). Prefrontal system dysfunction and credit card debt. *International Journal of Neuroscience, 114*(10), 1323-1332.

Spinella, M., Yang, B., & Lester, D. (2007). Development of the executive personal finance scale. *International Journal of Neuroscience, 117*(3), 301-313.

Spinella, M., Lester, D., & Yang, B. (2015). Compulsive buying tendencies. *Psychological Reports, 117*(3), 649-655.

Solomon, M. R. (2014). *Consumer behavior: Buying, having, and being*. Engelwood Cliffs, NJ: Prentice Hall.

Stanford, M. S., Greve, K. W., & Gerstle, J. E. (1997). Neuropsychological correlates of self reported impulsive aggression in a college sample. *Personality and Individual Differences, 23(*6), 961-965.

Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences, 47*(5), 385-395.

Stern, H. (1962). The significance of impulse buying today. *The Journal of Marketing, 26*(2), 59-62.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*(3), 220-247.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643-662.

Stuss, D. T., & Benson, D. F. (1986). *The frontal lobes*. Raven Press.

Swann, A. C., Pazzaglia, P., Nicholls, A., Dougherty, D. M., & Moeller, F. G. (2003). Impulsivity and phase of illness in bipolar disorder. *Journal of Affective Disorders, 73*(1), 105-111.

Taylor, S. P. (1967). Aggressive behavior and physiological arousal as a function of provocation and the tendency to inhibit aggression. *Journal of Personality, 35*(2), 297-310.

Thurstone, L. L. (1953). *Examiner manual for the Thurstone Temperament Schedule* (2nd ed.). Chicago IL, US: Science Research Associates.

Tupes, E. C., & Christal, R. C. (1958). Stability of personality trait rating factors obtained under diverse conditions. *USAF Wright Air Development Center Technical Note, 58-61*, 16.

Uleman, J. S., Newman, L. S., & Moskowitz, G. B. (1996). People as flexible interpreters: Evidence and issues from spontaneous trait inference. *Advances in Experimental Social Psychology, 28,* 211-279.

Unsworth, N., Redick, T. S., Heitz, R. P., Broadway, J. M., & Engle, R. W. (2009). Complex working memory span tasks and higher-order cognition: A latent-variable analysis of the relationship between processing and storage. *Memory, 17*(6), 635-654.

Villemarette-Pittman, N. R., Stanford, M. S., & Greve, K. W. (2003). Language and executive function in self-reported impulsive aggression. *Personality and Individual Differences, 34*(8), 1533-1544.

Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research, 33*(4), 537-547.

Wain, O., & Spinella, M. (2007). Executive functions in morality, religion, and paranormal beliefs. *International Journal of Neuroscience, 117*(1), 135-146.

Washburn, D. A., & Putney, R. T. (1999). *Assessment software for attention profiles*. Atlanta, GA, US: Morris Brown College.

Watson, S. (2009). Credit card misuse, money attitudes, and compulsive buying behaviors: A comparison of internal and external locus of control. *College Student Journal, 43*(2), 268-275.

Wechsler, D. (2014). *Wechsler Adult Intelligence Scale–Fourth Edition (WAIS–IV)*. New York, NY, US: Pearson Education.

Wiebe, S. A., Espy, K. A., & Charak, D. (2008). Using confirmatory factor analysis to understand executive control in preschool children: I. Latent structure. *Developmental Psychology, 44*(2), 575.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*(4), 669-689.

Whitney, P., Jameson, T., & Hinson, J. M. (2004). Impulsiveness and executive control of working memory. *Personality and Individual Differences, 37*(2), 417-428.

Wittmann, M., Leland, D. S., & Paulus, M. P. (2007). Time and decision making: Differential contribution of the posterior insular cortex and the striatum during a delay discounting task. *Experimental Brain Research, 179*(4), 643-653.

Yamauchi, K. T., & Templer, D. J. (1982). The development of a money attitude scale. *Journal of Personality Assessment, 46*(5), 522-528.

Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Blackwell Handbook of Childhood Cognitive Development* (pp. 445-469). Malden, MA, US: Blackwell Publishing.

APPENDICES

Appendix A: Executive Function Index

Rate how well each of the following statements describes you.

I have a lot of enthusiasm to do things. MD
When doing several things in a row, I mix up the sequence. ORG
I try to plan for the future. SP
I can sit and do nothing for hours.MD
I take risks, sometimes for fun. IC
I have trouble when doing two things at once, multi-tasking. ORG
I'm interested in doing new things. MD
I have a lot of concern for the well-being of other people. EMP
I'm an organized person. ORG
I save money on a regular basis. SP
I do or say things that others find embarrassing. IC
People who are foolish enough to be taken advantage of deserve it. EMP
I only have to make a mistake once in order to learn from it. SP
I tend to be an energetic person. MD
I make inappropriate sexual advances or flirtatious comments. IC
When someone is in trouble, I feel the need to help them. EMP
I sometimes I lose track of what I'm doing. ORG
I feel protective towards a friend who is being treated badly. EMP
I think about the consequences of an action before I do it. SP
I lose my temper when I get upset. IC
I take other people's feelings into account when I do something. EMP
I have trouble summing up information in order to make a decision with it. ORG
I start things, but then lose interest and do something else. ORG
I swear/use obscenities. IC
I don’t like it if my actions or words hurt someone else. EMP
I use strategies to remember things. SP
I monitor myself so that I can catch any mistakes. SP

Appendix B: Credit Card Misuse Scale Items

1. I am less concerned with the price of a product when I use a **credit card**.
2. I rarely go over my available **credit** limit.
3. I always pay off my **credit cards** at the end of the month.
4. I am more impulsive when I shop with **credit cards**.
5. I have too many **credit cards**.
6. I worry how I will pay off my **credit card** debt.
7. I seldom take cash advances on my **credit cards**.
8. I often make only the minimum payment on my **credit card** bills.
9. My **credit cards** are usually at their maximum **credit** limit.
10. I frequently use available **credit** on one **credit card** to make a payment on another credit card.
11. I am seldom delinquent in making payments on my credit cards.
12. I spend more when I use a credit card.

Appendix C: Brief Barratt Impulsivity Measure (BIS-8)

How well do the following statements describe your personality? Please select "1" for strongly disagree and "5" for strongly agree**. [DO NOT RANDOMIZE]**

	I see myself as someone who…
1	I plan tasks carefully. (Plan)
2	I do things without thinking. (Action)
3	I don't "pay attention." (Action)
4	I am self-controlled. (Plan)
5	I concentrate easily. (Plan)
6	I am a careful thinker (Plan).
7	I say things without thinking. (Action)
8	I act on the spur of the moment. (Action).

Appendix D: Ten-Item Personality Inventory (TIPI)

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

TIPI scale scoring (‘‘R’’ denotes reverse-scored items): Extraversion: 1, 6R; Agreeableness: 2R, 7; Conscientiousness; 3, 8R; Emotional Stability: 4R, 9; Openness to Experiences: 5, 10R

Appendix E: Descriptive Statistics for Study 1, Part A

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
valueseeking	6122	1.00	7.00	4.5773	1.38420
spenders	6122	1.00	7.00	3.5939	1.65433
CCMIsuse	6122	1.00	5.00	2.4078	.81379
extroversion	6122	1.00	7.00	3.9137	1.34397
Agreeableness	6122	1.00	7.00	4.8239	1.17276
consicentiousness	6122	1.00	5.00	3.2560	1.05783
neuroticism	6122	1.00	7.00	3.4343	1.28605
Openness	6122	1.00	7.00	4.7821	1.18186
Impulseaction	6122	1.00	5.00	2.6800	.96624
Impulseplan	6122	1.00	5.00	2.2714	.80077
IMPULSE	6122	1.00	5.00	2.4757	.68269
EXFUNCOVERAL L	6122	1.89	4.96	3.4246	.44892
EXEFMD	6122	1.00	5.00	3.4469	.71629
EXEFORG	6122	1.00	5.00	3.2260	.92920
EXEFSP	6122	1.29	5.00	3.4316	.57961
EXEFIC	6122	1.00	5.00	3.1930	.88420
EXEFEM	6122	1.00	5.00	3.7600	.70896
Valid N (listwise)	6122				

Appendix F: Descriptive Statistics for Study 1, Part A

		Impulse action	Impulse plan	Motivational Drive	Organization	Strategic Planning	Impulse Control	Empathy	Value Seeking	Spenders	Credit Card Misuse	AGE
Impulse action	1											
Impulse plan	.187**	1										
EFI Motivational Drive	-.096**	-.376**	1									
EFI Organization	-.573**	-.090**	.071**	1								
EFI Strategic Planning	-.088**	-.518**	.487**	-.099**	1							
EFI Impulse Control	-.565**	.020	-.028*	.650**	-.122**	1						
EFI Empathy	-.119**	-.288**	.410**	.054**	.457**	.107**	1					
Value Seeking	.115**	-.267**	.189**	-.186**	.324**	-.160**	.225**	1				
Spenders	.457**	.013	-.018	-.478**	.032*	-.467**	-.016	.224**	1			
Credit Card Misuse	.423**	.090**	-.081**	-.521**	-.090**	-.486**	-.201**	.041**	.527**	1		
AGE	-.244**	-.050**	.002	.322**	-.034**	.387**	.101**	.021	-.265**	-.334**	1	

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix G: Correlations for Study 1, Part B

		impulseconsumer	Openness	neuroticism	conscientiousness	Agreeableness	extroversion	EXEFMD	EXEFORG	EXEFSP	EXEFIC	EXEFEM
impulseconsumer	1											
Openness	-.100**	1										
neuroticism	.220**	-.241**	1									
conscientiousness	.063**	.030*	-.216**	1								
Agreeableness	-.184**	.308**	-.359**	.026*	1							
extroversion	.038**	.205**	-.131**	.118**	-.053**	1						
EXEFMD	.059**	.417**	-.283**	.312**	.179**	.360**	1					
EXEFORG	-.525**	.253**	-.374**	-.049**	.273**	.072**	.071**	1				
EXEFSP	.152**	.193**	-.212**	.502**	.127**	.112**	.487**	-.099**	1			
EXEFIC	-.496**	.121**	-.328**	-.096**	.397**	-.094**	-.028*	.650**	-.122**	1		
EXEFEM	.044**	.343**	-.186**	.151**	.462**	.071**	.410**	.054**	.457**	.107**	1	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Appendix H: Descriptive Statistics for Study 1, Part B

	N	Minimum	Maximum	Mean	Std. Deviation
opportunityseekers	6000	1.00	7.00	1.7868	1.62829
ccmisuse	6000	1.00	5.00	2.2468	.82632
financialrisk	6000	2.00	10.00	3.8225	2.24384
agree2	6000	1.00	7.00	4.9910	1.19809
neuro2	6000	1.00	7.00	3.3421	1.35766
open2	6000	1.00	7.00	4.7416	1.19090
consien2	6000	1.00	7.00	5.4034	1.27782
EFI	6000	1.41	4.89	3.4963	.45759
impulseplan	6000	1.00	5.00	2.2203	.76752
impulseaction	6000	1.00	5.00	2.5141	.98643
impulsivity	6000	1.00	5.00	2.3672	.69138
extro2	6000	1.00	7.00	3.7813	1.40603
execmd	6000	1.00	5.00	3.4266	.74739
execorg	6000	1.00	5.00	3.3540	.95573
execsp	6000	1.00	5.00	3.4441	.57993
execic	6000	1.00	5.00	3.4075	.93164
execem	6000	1.00	5.00	3.7962	.68400
Valid N (listwise)	6000				

Appendix I: Correlations for Study 1, Part B

	Age	Motivational Drive	Organization	Strategic Planning	Impulse Control	Credit Card Misuse	Financial risk taking	Impulse Plan	Impulse Action	Opportunity seekers
Age	1									
Motivational Drive	.038**	1								
Organization	-.408**	.068**	1							
Strategic Planning	.062**	.478**	-.078**	1						
Impulse Control	-.436**	-.012	.692**	-.086**	1					
Credit card misuse	.412**	-.034**	-.538**	-.084**	-.542**	1				
Finance risk taking	.257**	.085**	-.462**	.134**	-.552**	.479**	1			
Impulse plan	.054**	-.404**	-.099**	-.563**	-.025	.086**	-.093**	1		
Impulse action	.289**	-.089**	-.629**	-.108**	-.663**	.495**	.478**	.231**	1	
Opportunity seekers	.359**	.124**	-.518**	.205**	-.547**	.522**	.655**	-.170**	.452**	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix J: Correlations for Study 1, Part B

		Motivational Drive	Organization	Strategic Planning	Impulse Control	Impulse Plan	Impulse Action	extroversion	agreeableness	neuroticism	openness	conscientiousness
Motivational drive	1											
organization	.068**	1										
Strategic planning	.478**	-.078**	1									
Impulse control	-.012	.692**	-.086**	1								
Impulse plan	-.404**	-.099**	-.563**	-.025	1							
Impulse action	-.089**	-.629**	-.108**	-.663**	.231**	1						
extroversion	.410**	.015	.156**	-.135**	-.100**	.093**	1					
agreeableness	.198**	.346**	.134**	.477**	-.183**	-.379**	-.048**	1				
neuroticism	-.329**	-.390**	-.228**	-.376**	.358**	.369**	-.147**	-.452**	1			
openness	.449**	.225**	.187**	.103**	-.155**	-.183**	.242**	.248**	-.226**	1		
Conscientiousness	.271**	.564**	.302**	.485**	-.396**	-.540**	.061**	.401**	-.454**	.299**	1	

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix K: Descriptive Statistics for Study 2

Behavioral Measures	N	Minimum	Maximum	Mean	Std. Deviation
corsispan_mean	253	.000	5.700	3.922	1.082
Stroop differencescore	252	-230.228	932.642	120.678	131.713
taskswitch_mixcost	253	-592.949	1767.104	227.624	248.148
taskswitch_switchcost	253	-615.622	1342.712	320.288	528.154
gambling	253	.000	.930	.469	.218
gonogo_go_rt (ms)	253	186.157	985.000	417.209	82.726
gonogo_nogo_errorrate	253	.0	1.0	.136	.178
stopsignal_errorrate	253	.660	1.000	.856	.076
wisconsin_preservationerror	253	.066	.400	.154	.070
nbackmiss	251	.00	1.00	.319	.257
nbackfalspos	253	.00	.54	.128	.098
nbacktotal	252	.00	1.88	.4710	.360
Valid N (listwise)	250				

Appendix L: Descriptive Statistics for Study 2 Self-Report Measures

	N	Minimum	Maximum	Mean	Std. Deviation
Impulsivity	253	1	49	15.05	8.348
Credit card	253	.00	7.00	3.2451	1.13574
Motivational drive	253	1.75	7.00	4.7717	1.24285
Strategic planning	253	2.29	7.00	5.3027	.93255
Impulse control	253	1.25	7.00	4.5494	1.24105
Organization	253	.00	7.00	4.4964	1.33685
Credit card misuse	253	.00	5.91	2.8383	1.32323
Impulse plan	253	.00	25.00	5.9605	4.36236
Impulse action	253	1.00	27.00	9.0909	4.92600
extraversion	253	.5	6.5	3.008	1.8225
agreeableness	253	.0	7.0	4.891	1.4251
conscientiousness	253	1.5	7.0	5.170	1.2913
Emotionally stable	253	.0	7.0	4.488	1.6985
openness	253	.5	7.0	4.494	1.4124
Valid N (listwise)	253				

Appendix M: Purchasing Descriptive Statistics for Study 2

	N	Minimum	Maximum	Mean	Std. Deviation
purchasing.1	253	200	1000	315.55	131.125
purchasing2.1	253	1	2	1.33	.470
purchasing3.1	253	1	2	1.65	.478
purchasing4cruise.1	253	1	2	1.52	.501
purchasing6.1	253	1	2	1.70	.459
purchasing4b.1	253	1	2	1.87	.342
purchasing7.1	253	1	2	1.67	.470
purchasing8.1	253	1	2	1.77	.421
purchasing9.1	253	1	2	1.60	.490
buy9b.1	253	1	2	1.82	.386
purchasing11.1	253	1	2	1.91	.282
buy10.1	253	1	2	1.91	.282
purchasing12.1	252	0	1400	410.32	197.512
purchasing13.1	253	1	2	1.86	.350
purchasediff	253	-1750.00	498.00	-132.3518	219.54764
purchasebudget	253	-1800.00	350.00	-95.6877	302.22527
purchaseyesno	253	13.00	26.00	22.6087	2.99223
Valid N (listwise)	252				

Appendix N: Correlations for Study 2

		Age	Credit Card Misuse	Impulse Plan	Impulse Action	Total Purchase	Working Memory	Inhibitory Control	Cognitive Flexibility
Age	1								
Credit Card Misuse	-.176**	1							
Impulse Plan	-.007	.139*	1						
Impulse Action	-.203**	.371**	.614**	1					
Total Purchase	.130*	-.456**	.006	-.244**	1				
Working Memory	-.207**	.044	-.052	.159*	-.171**	1			
Inhibitory Control	-.065	.202**	.113	.230**	-.255**	.155*	1		
Cognitive Flexibility	.035	.001	-.028	-.052	.033	-.066	-.015	1	

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

		Age	Credit Card Misuse	Impulse Plan	Impulse Action	Total Purchase	Working Memory	Inhibitory Control	Cognitive Flexibility
Age	Pearson Correlation	1							
	Sig. (2-tailed)								
	N	253							
Credit Card Misuse	Pearson Correlation	-.176**	1						
	Sig. (2-tailed)	.005							
	N	253	253						
Impulse Plan	Pearson Correlation	-.007	.139*	1					
	Sig. (2-tailed)	.918	.027						
	N	253	253	253					
Impulse Action	Pearson Correlation	-.203**	.371**	.614**	1				
	Sig. (2-tailed)	.001	.000	.000					
	N	253	253	253	253				
Total Purchase	Pearson Correlation	.130*	-.456**	.006	-.244**	1			
	Sig. (2-tailed)	.039	.000	.927	.000				
	N	253	253	253	253	253			
Working Memory	Pearson Correlation	-.207**	.044	-.052	.159*	-.171**	1		
	Sig. (2-tailed)	.001	.492	.411	.011	.007			
	N	251	251	251	251	251	251		
Inhibitory Control	Pearson Correlation	-.065	.202**	.113	.230**	-.255**	.155*	1	
	Sig. (2-tailed)	.301	.001	.074	.000	.000	.014		
	N	252	252	252	252	252	250	252	
Cognitive Flexibility	Pearson Correlation	.035	.001	-.028	-.052	.033	-.066	-.015	1
	Sig. (2-tailed)	.575	.990	.661	.410	.605	.294	.807	
	N	253	253	253	253	253	251	252	253

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix O: Study 2 Correlations between EFI and Personality Measures

	Organization	Impulse Control	Strategic Planning	Motivational Drive	Extroversion	agreeableness	conscientiousness	neuroticism	openness
EFI Organization	1								
EFI Impulse Control	.513**	1							
EFI Strategic Planning	.189**	.105	1						
EFI Motivational Drive	.320**	-.033	.416**	1					
Extroversion	.182**	-.086	.233**	.628**	1				
Agreeableness	.361**	.328**	.275**	.341**	.159*	1			
Conscientiousness	.344**	.223**	.532**	.361**	.162**	.415**	1		
Neuroticism	.396**	.180**	.288**	.440**	.349**	.440**	.392**	1	
Openness	.287**	.004	.197**	.553**	.373**	.293**	.282**	.368**	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix P: Study 2 EFI and Cognitive Flexibility Correlations

		Motivational Drive	Strategic Planning	Impulse Control	Organization	Wisconsin Perseveration	Wisconsin Nonpersev	taskswitch_mix cost	taskswitch_swi tchcost
Motivational Drive	1								
Strategic Planning	.416**	1							
Impulse Control	-.033	.105	1						
Organization	.320**	.189**	.513**	1					
Wisconsin Perseveration	.052	-.078	-.170**	-.124*	1				
Wisconsin Non Perseveration Error	.122	-.074	-.027	.000	.542**	1			
Taskswitch Mixcost	.080	.059	.170**	.033	.021	.105	1		
Taskswitch Switchcost	.035	-.069	-.009	.025	-.064	.032	.022	1	

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix Q: Study 2 Correlations of Inhibitory Control Behavioral Measures and EFI Subscales

		Stroop	Go/Nogo RT	Go/Nogo Error	Stopsignal Error	Stroop Error	Motivational Drive	Strategic Planning	Impulse control	Organization
Stroop	1									
Go/Nogo RT	.083	1								
Go/Nogo Error	-.019	-.174**	1							
Stopsignal Error	.017	-.159*	.121	1						
Stroop Error	.100	.015	.075	.001	1					
Motivational Drive	.070	.024	-.029	-.002	-.015	1				
Strategic Planning	-.004	-.033	-.039	.099	-.117	.416**	1			
Impulse Control	.024	-.070	-.111	-.161*	-.034	-.033	.105	1		
Organization	.015	-.142*	-.085	-.220**	.004	.320**	.189**	.513**	1	
N										

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix R: Study 2 Correlations of Working Memory Behavioral Measures and EFI Subscales

	Corsi Mean	Nback Misses	Nback False Positives	Motivational Drive	Strategic Planning	Impulse Control	Organization
Corsi Mean	1						
Nback Misses	-.122	1					
Nback False Positives	-.235**	.218**	1				
EFI Motivational Drive	-.102	.043	.024	1			
EFI Strategic Planning	.082	.033	.077	.416**	1		
EFI Impulse Control	.094	-.198**	.004	-.033	.105	1	
EFI Organization	.101	-.160*	-.058	.320**	.189**	.513**	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix S: Correlations Study 2 Correlations of Working Memory Behavioral Measures and EFI Subscales

	Motivational Drive	Strategic Planning	Impulse Control	Organization	Cognitive Flexibility	Inhibitory Control	Working Memory
Motivational Drive	1						
Strategic Planning	.240	1					
Impulse Control	-.117	-.015	1				
Organization	.071	-.036	.483	1			
Cognitive Flexibility	.085	-.041	.063	.052	1		
Inhibitory Control	.123	.050	-.122	-.150	-.015	1	
Working Memory	.005	.059	-.113	-.063	-.075	.156	1

Appendix T: Partial Correlations of Personality Measures and EFI Subscales

	extroversion	agreeableness	conscientiousness	Neuroticism	Openness	Cognitive Flexibility	Inhibitory Control	Working memory
Extroversion	1							
Agreeableness	.159*	1						
Conscientiousness.	.162**	.415**	1					
Neuroticism	.349**	.440**	.392**	1				
Openness	.373**	.293**	.282**	.368**	1			
Cognitive Flexibility	.013	.048	-.009	-.056	.009	1		
Inhibitory Control	.039	-.107	-.160*	-.041	-.098	-.015	1	
Working Memory	.171**	-.055	-.078	-.036	.050	-.032	.345**	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Appendix U: Purchasing Task Questions and Order of Behavioral Tasks

Age
Purchasing Q1: Your only mobile device has been damaged and needs to be replaced. You have $1000 in savings to spend, but have other ideas for that money as well, including taking a vacation, saving for the holidays, supporting a charitable cause, and maintaining an emergency fund in savings. You can get a refurbished device that has all the functional features for $200 (minimum memory, adequate screen size, satisfactory function). However, it is a basic model. You can purchase upgrades (and will be allowed to do so later in this survey). What is the most from your $1000 would you be willing to spend on such a device, including those additional upgrades?
-{min=200,max=1000}
Gender
Stopsignal
Purchasing Q2: Instead of getting a refurbished mobile device, you can get a brand new device for only $200 more. Would you like to do that?
Go/nogo
Ethnicity
Purchasing Q3: You can purchase a waterproof, shatterproof case to protect your mobile device for an additional $75? Would you like to do so?
- yes
- no
Purchasing Q4 Cruise: You just received an offer for a five night all inclusive Caribbean cruise for just $300. Would you like to purchase this opportunity with your leftover savings?
TIPI Personality
Wisconsin Card Sort
Purchasing Q5: Regarding the mobile device mentioned earlier, adding memory allows you to download more apps, stream more movies, and store more pictures, videos and music. Would you be willing to pay an additional $150 for 50% more memory?
Nback 1
Purchasing Q5d: There is a special now for purchasing additional memory. You can buy 50% more memory for just $75 now. Would you like to do so?
Nback 2
Barratt Impulsiveness 8
Purchasing Q6: You can increase photo resolution and add a zoom feature to the camera on your mobile device for $30. Would you like to purchase this
TaskSwitching
Purchasing Q6b: About the mobile device mentioned earlier, the smallest screen is sometimes difficult to read or to watch videos. For $80 more, you could upgrade to a newer version with double the screen size. Would you want to have a larger mobile device for that amount of money?
Stroop
Purchasing Q7: Would you like new bluetooth headphones to go with your mobile device for an additional $75?
CORSI

Purchasing Q8: The current mobile device you have chosen comes with the most basic battery. For an additional $50, you can upgrade the battery, allowing for ongoing usage without charge for 48 hours. Would you like to purchase the battery upgrade?
CORSI 2
Purchasing Q9: The mobile device that you have chosen previously only comes in an obnoxious lime green color for the price. Would you choose to pay an additional $50 for the color of your choice?
Iowa Gambling
Purchasing Q10: A charger (with adapters for car and computer) is not included with your mobile device. Would you like to add that on for $50?
Purchasing Q11: Currently, your mobile device comes with no policy for replacement if damaged. You may add a plan that replaces your phone whenever it is damaged, no questions asked, to your purchase for an additional $150 one-time fee. Would you like to do so?
Purchasing Q12: Phone security continues to be a concern, as the world becomes increasingly more digital. You can upgrade your mobile device to the Maximum Security Subscription for a flat fee of $150. Would you like to do that?
Purchasing Q13: You may select a service plan for your mobile device. For a one-time fee of $175, you receive a year of unlimited one-on-one time with tech support from the mobile device company. In addition, you do not have to set up an appointment and there will never be a wait for this service. Would you like to purchase that plan?
Purchasing Q14: Just to be clear, can you tell me how much you have agreed to spend on your mobile device up to this point?
Purchasing Q15: The provider of the mobile device discussed previously now has an offer for a second, larger electronic tablet to go with your mobile device for only $250 more. Would you want to accept that offer?
Credit Card Misuse
Purchasing Q15: What is the total you have spent on the mobile device?
Purchasing Q16: What was the original amount you budgeted for your mobile device plus upgrades?

Appendix V: Study 1A, Means of Quartile Split Extreme Groups

	Impulsive Purchasing Behavior	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Organization	Low	3.843	.022	3.800	3.886
	Low Medium	3.574	.022	3.530	3.617
	Medium	3.435	.058	3.320	3.549
	High	2.565	.022	2.522	2.607
Impulse Control	Low	3.945	.020	3.906	3.985
	Low Medium	3.693	.020	3.654	3.733
	Medium	3.336	.053	3.231	3.440
	High	2.542	.020	2.503	2.581

Appendix W: Study 1B, Means of Quartile Split Extreme Groups

	Impulsive Purchasing Behavior	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Organization	Low	3.092	.010	2.073	2.111
	Low Medium	2.056	.010	2.037	2.075
	Medium	1.999	.010	1.980	2.018
	High	1.742	.010	1.723	1.760
Impulse Control	Low	3.107	.010	2.088	2.125
	Low Medium	2.046	.010	2.027	2.065
	Medium	1.983	.010	1.964	2.002
	High	1.728	.009	1.710	1.747