ASSOCIATIONS BETWEEN SELF-REPORT MEASURES OF EMOTION REGULATION AND PERFORMANCE-BASED MEASURES OF EXECUTIVE FUNCTIONING

A thesis presented to the faculty of the Graduate School of Western Carolina University in partial fulfillment of the requirements for the degree of Master of Arts in Psychology.

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LIST OF ABBREVIATIONS

EF: Executive Functioning
DERS: Difficulties in Emotion Regulation Scale
MMPI-3: Minnesota Multiphasic Personality Inventory-Third Edition
BRIEF: Behavior Rating Inventory for Executive Functioning
BRIEF-P: Behavior Rating Inventory of Executive Functioning
BRIEF-SR: Behavior Rating Inventory of Executive Functioning
BRIEF-2: Behavior Rating Inventory of Executive Functioning
BRIEF-A: Behavior Rating Inventory of Executive Functioning
AEFI: Amsterdam Executive Function Inventory
BDEFS: Barkley Deficits in Executive Functioning Scale
ADHD: Attention-deficit/Hyperactivity Disorder
TBI: Traumatic Brain Injury
IRB: Internal Review Board
SPSS: Statistical Package for Social sciences
EFA: exploratory factor analysis
RMSEA: root-mean-square error of approximation
CFI: Comparative Fit index
TLI: Tucker Lewis index
SRMR: standardized root mean square residual
CI: Confidence interval
MI: modification indices
DS: Digit Span
EID: Emotional/Internalizing Dysfunction
THD: Thought Dysfunction
BXD: Behavioral/Externalizing Dysfunction
RCd: Demoralization
RC1: Somatic Complaints
RC2: Low Positive Emotions
RC4: Antisocial Behavior
RC6: Ideas of Persecution
RC7: Dysfunctional Negative Emotions
RC8: Aberrant Experiences
RC9: Hypomanic Activation
MLS: Malaise
NUC: Neurological Complaints
EAT: Eating Concerns
COG: Cognitive Complaints
SUI: Suicidal/Death Ideation
HLP: Helplessness/Hopelessness
SFD: Self-Doubt
NFC: Inefficacy
STR: Stress

WRY: Worry
CMP: Compulsivity
ARX: Anxiety-Related Experiences
ANP: Anger Proneness
BRF: Behavior-Restricting Fears
FML: Family Problems
JCP: Juvenile Conduct Problems
SUB: Substance Abuse
IMP: Impulsivity
ACT: Activation
AGG: Aggression
CYN: Cynicism
SFI: Self-Importance
DOM: Dominance
DSF: Disaffiliativeness
SAV: Social Avoidance
SHY: Shyness
AGGR: Aggressiveness
PSYC: Psychoticism
DISC: Disconstraint
NEGE: Negative Emotionality/Neuroticism
INTR: Introversion/Low Positive Emotionality

ABSTRACT

ASSOCIATIONS BETWEEN SELF-REPORT MEASURES OF EMOTION REGULATION AND PERFORMANCE-BASED MEASURES OF EXECUTIVE FUNCTIONING

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Executive functioning (EF) is a crucial component of everyday functioning across many settings. Past research has examined ways in which emotions, including emotion dysfunction, are related to the processes of EF. Further, individual differences across a variety of emotion regulation processes can impact EF to a meaningful degree, and there has been much research dedicated to determining the role that emotion regulation has in EF (Gross, 2002; Gross & Jazaieri, 2014; Sudikoff et al., 2015). In the current work, the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) and the Minnesota Multiphasic Personality Inventory-3 (MMPI-3; Ben-Porath & Tellegen, 2020a), which includes a range of emotion dysfunction-related variables, were used to explore correlations with performance-based EF tasks, including the Trail Making Test (A & B), Clock Drawing, FAS, Animal Naming, and Digit Span. Of note, no prior research has investigated the correlative properties of performance-based EF tasks with the MMPI-3. Two bivariate correlations were conducted to evaluate the association between the MMPI-3 and the performance-based measures and the DERS and performance-based measures. While none of the performance-based measures meaningfully associated with the DERS scales, a few, though not all, of the performance-based measures

correlated meaningfully to the Emotional/Internalizing scales, Externalizing scales, and Interpersonal scales for the MMPI-3 to a meaningful degree. An exploratory factor analysis of the EF tasks was conducted though unable to be interpreted most likely due to the shared method variance of the performance-based measures. Overall, this research shows a potential relationship between constructs of executive functioning and constructs related to emotional processing and regulation.

Keywords: executive functioning, working memory, cognitive flexibility, emotion regulation, MMPI-3, DERS

CHAPTER ONE: INTRODUCTION

Executive functioning (EF) is a crucial component of human performance in a variety of settings. Research has examined associations between emotional processes, including emotion regulation strategies and emotion regulation dysfunction, and various component processes of EF. Individual differences across a variety of emotion regulation processes can impact EF processes to a meaningful degree, and there has been much research dedicated to determining the role that emotion regulation has in EF (Gross, 2002; Gross & Jazaieri, 2014; Stephens et al., 2022; Sudikoff et al., 2015). Much of the research on EF has utilized self-report measures to determine the levels and patterns of EF for an individual; however, discrepancies between performance-based measures and self-report measures have suggested differences in what is being measured specifically. In this study, correlations were examined between emotional constructs measured by two widely-used self-report instruments, the Minnesota Multiphasic Personality Inventory-3 (MMPI-3; Ben-Porath & Tellegen, 2020a) and the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), and seven different performance tasks measuring aspects of EF.

Executive Functioning

The term *executive functioning* has been described using a variety of different factors, suggesting that the construct is multidimensional in nature (Banich, 2009). In the process of developing this construct, EF has become an umbrella term with a lack of clear agreement in its operationalization (Banich, 2009; Goldstein et al., 2014; McCabe et al., 2010). Not only has the term been difficult to explicitly define, but several differing theoretical models exist to describe the process(es) of EF, thereby making it even more challenging to utilize as a unifying concept (Barkley, 2001; Banich, 2009; Goldstein et al., 2014; Miller & Cohen, 2001). While some models posit that EF is best represented with a coherent hierarchical model (McCabe et al., 2010), others have posited that

EF is better defined as a variety of distinct functions under an overarching label of EF (McCabe et al., 2010). In the process of defining EF, a multitude of cognitive processes have been identified under the heading of EF such as planning, problem solving, verbal reasoning, sequencing, attention maintenance, cognitive flexibility, multitasking, resistance to interference, utilization of feedback, and the ability to deal with new information (Banich, 2009; Chan et al., 2008; McCabe et al., 2010). Diamond (2013) offers a consolidated review of various EF concepts and identifies three mid-level factors that are useful in organizing this diverse set of constructs: working memory, cognitive flexibility, and inhibitory control. Although it is recognized that there are still a variety of models that have been used to define EF (Goldstein et al., 2014) and new models are still being developed, such as the recently proposed "hot" and "cold" model of EF relating emotion to EF skills as reviewed by Salehinejad et al. (2021), the current study will use the Diamond (2013) three-factor model as a tentative framework for organizing the tasks, measures, and findings.

First, *working memory* is essentially, and most commonly, described as the system responsible for maintaining and manipulating information over short periods of time (McCabe et al., 2010). It has been documented that difficulties in working memory can be linked to neurocognitive impairments in older adults and traumatic brain injuries (McAllister et al., 2006; Salami et al., 2018). *Cognitive flexibility*, another cognitive process that is linked to EF, has been defined as a process by which individuals switch or adjust approaches to new demands, rules, or problems (Diamond, 2013). *Inhibitory control*, according to Diamond (2013), is the third core concept under EF, involving the ability to control attention, behavior, thoughts, and/or emotions in the face of external stimuli, to act instead for what is necessary or appropriate. The three concepts introduced above are proposed as core components of EF (Diamond, 2013), and we have selected tasks related to these core constructs. It should be noted, however, that many tasks related to EF fall under several EF-related abilities (e.g., planning, problem solving, verbal reasoning, etc.) and thus are interconnected across the three

constructs described above (Diamond, 2013). For example, two of tasks chosen for this study, FAS and Animal Naming, which are typically described as measures of verbal fluency, are also seen to have association to the umbrella terms of inhibitory control (or executive control) and working memory (Shao et al., 2014), which themselves have been shown as interconnected. Verbal fluency tasks have been heavily used in assessment and clinical practice for a variety of measurements related to executive control and lexical knowledge/retrieval ability (Shao et al., 2014). Similar interconnectedness has been found in the subdomain of cognitive flexibility. In summary, while a conceptual organizing framework such as that described by Diamond (2013) is helpful in research design, it is important to note that this is an area of research that is replete with both jingle fallacies and jangle fallacies (see Block, 1995).

Measuring Executive Functioning

From a clinical standpoint, the assessment of EF is crucial to develop proper treatment plans for several diagnoses such as traumatic brain injury (TBI), neurocognitive degeneration, learning disabilities, Parkinson's, and attention-deficit/hyperactivity disorder (ADHD), to name a few (Barkley & Murphy, 2010; Lanni et al., 2014). The measurement of EF has been under ongoing investigation as to which category of measurement, self-report versus performance-based tasks, are more reflective of executive dysfunction in a variety of clinical settings (Lanni et al., 2014). However, as Buchanan (2016) notes, while performance-based neuropsychological measures such as the Trail Making Test are common and valuable tools to measure EF, there is also a strong argument that self-report measures have substantial value in measuring perceived EF for a variety of psychological and neurological dysfunctions (Barkley & Murphy, 2010). With both types of measures, further research is still needed to determine what exact constructs are being measured respective to the type of measure.

Self-Report Measures of Executive Functioning. Ratings of perceived EF ability are often assessed using self-report measures in a variety of different clinical settings (Braun et al., 2021). Though several self-report measures exist for EF such as the Amsterdam Executive Function Inventory (AEFI; Van der Elst et al., 2012) and the Barkley Deficits in Executive Functioning Scale (BDEFS; Barkley, 2011), the most frequently used measure is the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia et al., 2000; see survey results reported by Nyongesa et al., 2019). In different research endeavors within clinical populations, the appropriate form of the BRIEF is given, which could be the adult version (BRIEF-A), preschool version (BRIEF-P), self-report version (BRIEF-SR), or the newly released BRIEF-2. The appropriate form is often given to the client and/or a personal contact of the client to report on the perceived ability of the client's EF, outside of the research setting. Within the clinical setting, the self-report measures are provided to determine EF for an individual as a way to assess everyday EF performance, which may provide some indication of functioning outside of the testing environment (Gioia et al., 2010). Self-reported assessments have been argued to provide more utility in measuring EF which may not be captured in performance-based tasks, including emotion regulation (Lanni et al., 2014; Løvstad et al., 2012). Løvstad et al. (2012) concluded in their own study that analysis of the BRIEF-A in conjunction with performance-based neuropsychological testing provided different pieces of information, which could be beneficial to the case conceptualization of clients for different reasons. However, there has been noted difficulties in the validity of self-report scales. Suhr (2021) notes a variety of ways in which self-report assessments could be invalidated, including individuals responding carelessly, response bias, or underreporting of presenting symptoms. While some self-report measures, such as the BRIEF-A, do include validity scales; there is still the issue of understanding that the self-report measures have been found to correlate relatively weakly with performance measures of EF and instead may reflect a level of general psychological adjustment and may even be influenced by different levels of emotion

dysregulation (Donders & Strong, 2016; Løvstad et al., 2016). The research is therefore supporting that EF is difficult and complex to assess, and that it is also a necessity at this point to use a variety of assessment types to conceptualize the whole of EF.

Performance-Based Measures of Executive Functioning. In contrast to the perceived self-report measures, performance-based tasks such as the Trail Making Test and Digit Span, are often used to assess EF, usually in conjunction with self-reported ratings of EF (Lanni et al., 2014; Mason et al., 2020; Toplak et al., 2012). Using the two types of measures together is argued to provide a more comprehensive evaluation of clients to provide insight into how EF deficits are being reflected in everyday functioning (Gioia et al., 2010). However, the ability to use both types of measurements may not be necessarily feasible within a clinical setting under time constraints, and thus it is important to determine the exact nature of the information provided and whether one type of measure versus the other is more conclusive of the most necessary information.

A meta-analytic study conducted by Toplak et al. (2012) determined that only weak associations existed between self-report measures, such as the BRIEF, and performance-based tasks. Mason et al. (2020) concluded not only that correlations were negligible between performance-based and self-report measures, suggesting that the two types of measures are ultimately measuring different things, but they also asserted that performance-based measures may not have any usefulness in measuring cognitive ability when compared to the self-report measures. In comparison to this stance, Løvstad et al. (2016) argue that self-report data should be used along with other assessment strategies (e.g., performance-based measures) as a broad assessment strategy.

For the purposes of this study, performance-based measures were utilized to measure EF, with the Diamond (2013) three-factor model as an organizing conceptual framework. As noted above, there is not a one-to-one correspondence between a specific task and EF sub-construct. We selected seven tasks that are commonly used in cognitive and neuropsychological test batteries, striving to

cover the three mid-level concepts described by Diamond. The tasks themselves are described in the Method section below. Animal Naming, generally considered a verbal fluency task, taps cognitive flexibility, working memory, and inhibitory control. The FAS task, another verbal fluency measure, also reflects cognitive flexibility, working memory, and inhibitory control. The Trail Making Test is most closely linked to cognitive flexibility. Digit Span (backwards) is most notably related to working memory (Diamond, 2013). Finally, although Diamond (2013) did not specifically identify which EF facets it is associated with, Clock Drawing has been related to a variety of cognitive abilities including selective and sustained attention, auditory comprehension, verbal working memory, numerical knowledge, visual memory and reconstruction, visuospatial abilities, and on-demand motor execution (praxis; Mendes-Santos et al., 2015).

Emotion Regulation

Previous literature has demonstrated how different factors modify or mediate different aspects of EF, attempting to unravel the multitude of processes that impact EF (Banich, 2009). One such factor, emotion regulation, has recently come into focus as to the role it plays in different EF constructs. The topic of emotion regulation strategies has specifically attracted interest as several studies have indicated that the various degrees of utilizing, or a lack of utilizing, different strategies has been linked to many clinical populations such as ADHD and borderline personality disorder to name two (Predescu et al., 2020).

As executive dysfunction, including dysfunctions in the accompanying cognitive processes, has been heavily researched, so too has emotion dysregulation and its role in psychological dysfunction symptoms such as seen in ADHD and intellectual disabilities (Predescu et al., 2020). The relationship between EF and emotion regulation is widely researched and has largely focused on the emotion regulation strategies utilized by individuals (Aldao et al., 2010; McCrae & Gross, 2020). As noted above, most of this research has utilized self-report measures of EF; thus, a primary purpose of

the current study is to examine associations between emotion regulation and EF using performance-based measures of EF.

According to Gross (2002), emotion regulation refers to the involvement of processes that influence what emotions we have, when we have them, and how we experience and/or express them. In generating any emotion, McCrae and Gross (2020) state that there is a sequential method which individuals go through which starts with a situation, attention, followed by appraisal, and finally a response. The process model of emotion regulation, as described by Gross (2002), suggests that there are five families of strategies that can occur, including situation selection, situation modification, attentional deployment, cognitive change, and response modulation. McCrae and Gross (2020) argue that the emotion regulation cycle begins with the incongruence between one's goal emotional state and one's actual emotional state. From this incongruence, individuals are given the opportunity to regulate their emotions at different points in the sequential model of the generation of emotion, using any of the five regulatory strategies presented in the process model. This cycle, according to McCrae and Gross (2020), is monitored throughout the whole process for success or failure of the regulatory method in achieving its goal.

Gratz and Roemer (2004) attempted to create the DERS measure as a more comprehensive measurement of types of deficits in or barriers to effective emotion regulation. Prior to Gratz and Roemer (2004), previous literature focused on separate facets of emotion related to primarily the experiences of emotions, if individuals were able to experience the full range of emotions, and the various adaptive and maladaptive regulation strategies employed (Gratz & Roemer, 2004). The development of the DERS was a reflection of assessing the dimensions of emotion regulation through (a) awareness and understanding, (b) acceptance of emotions, (c) engagement in goal-directed behavior, and (d) emotion regulation strategies (Gratz & Roemer, 2004), which is more consistent with the function of emotions. Through the development of what is now known commonly as the

DERS, Gratz and Roemer (2004) discovered six aspects of emotion regulation that now encompass the subscales of the DERS. The first subscale is Nonacceptance of Emotional Responses which reflects an individual's tendency to have a negative response to their negative emotions. The next subscale is Difficulties Engaging in Goal-Directed Behavior which indicates an individual's difficulties in completing tasks when experiencing negative emotions. The Impulse Control Difficulties scale reflects an individual's difficulties in controlling behavior when experiencing negative emotions. The Lack of Emotional Awareness scale identifies an individual's tendency to acknowledge and attend to emotions. Next, the Limited Access to Emotion Regulation Strategies scale indicates and individual's belief that there is little that can be done to regulate emotions once an individual is in a bad mood. Finally, the Lack of Emotional Clarity scale reflects the extent to which an individual knows and understands the emotions they are experiencing (Gratz & Roemer, 2004).

Emotion Regulation Strategies and Executive Functioning

Research has suggested that emotion regulation and EF processes as well clinical symptoms are interconnected (Predescu, 2020). Schmeichel et al. (2008) found that working memory capacity was associated with differences in self-regulation of emotion. Those who had a lower working memory capacity were less successful at regulating their emotional responses. However, Marceau et al. (2018) found that task-switching performance (cognitive flexibility) was related to difficulties in emotion regulation, as measured by the DERS, whereas working memory and inhibition were not. The studies presented here reflect the broad inconsistency in the literature. While there have been efforts made to introduce theoretical models that connect emotion regulation and EF (Salehinejad et al., 2021), there is still a significant amount of overlap between the two umbrella terms of ER and EF that needs to be clarified. The lack of consensus in the data has driven this study to explore the connection between self-reported emotion regulation and performance-based EF measures especially in relation to the proposed EF constructs as indicated by Diamond (2013).

Purpose of the Current Study

Based on the previous literature, this study aimed to explore the correlations between self-reported difficulties in emotion regulation, as indicated by the DERS and MMPI-3, with performance-based EF tasks. The MMPI-3 provides a hierarchical-dimensional model of emotional/internalizing dysfunction, as well as additional scales that may relate to emotion regulation, such as ACT-Activation and RC9-Hypomanic Activation. Given the importance of these two constructs in the clinical settings across a variety of populations, this study was intended to elucidate the associations between common factors associated with EF and key constructs of emotion regulation, providing insight into the operationalization of EF. The lack of consensus in the data has driven this study to explore the connection between self-reported emotion regulation and performance-based EF measures especially in relation to the proposed EF constructs as indicated by Diamond (2013).

This study was exploratory in nature, guided by three main goals. The first goal was to examine the MMPI-3 scales, primarily those associated with emotional dysfunction, with performance-based measures of EF. At the time of writing this proposal, no study has focused on performance-based measures in relation to the newly released MMPI-3. Rationally, we expected strongest correlations to be with emotional functioning scales including RCd-Demoralization, RC7-Dysfunctional Negative Emotions, STR-Stress, WRY-Worry, CMP-Compulsivity, ARX-Anxiety-Related Experiences, and NEGE-Negative Emotionality/Neuroticism. As noted above, with regard to emotion regulation, we expected correlations with RC9-Hypomanic Activation and ACT-Activation. Finally, we predicted correlations between EF and certain somatic/cognitive scales, including NUC-Neurological Complaints and COG-Cognitive Complaints. The second goal for this study was to determine the associations between scores on the DERS total score and subscales scores and the performance-based EF measures. Finally, an exploratory factor analysis of the factor structure was

conducted for the seven EF tasks and compared this structure to the three-factor model proposed by Diamond (2013).

CHAPTER TWO: METHODS

Participants

In total, 219 participants were recruited from the local university human subject pool enrolled in an introductory psychology course that were recruited through the SONA system. Upon completion of the study, participants were awarded class credit via the SONA system. Inclusion criteria were (1) being 18 or over, (2) being an enrolled student at the university, (3) producing a valid MMPI-3 protocol, and (4) completing all six performance-based EF tasks (Digit Span Forward and Backward, Trails A and B, FAS, and Animals). Of the total recruited sample of 219, 20 produced invalid MMPI-3 protocols. Eight additional participants were excluded for incomplete performance-based measures, and one participant was excluded after identifying that they had sustained a recent concussion. Thus, the final sample size was 190. Exclusion of participants is discussed further for each respective analysis conducted for this study. The study was approved by Western Carolina University's Internal Review Board (IRB).

The demographics of the remaining participants (n = 190) were analyzed through the Statistical Package for Social sciences (SPSS) version 29. From the 190 participants, three participants did not identify their age. The remaining 187 participants' average age was 19.46 (SD = 2.46) years old. For n = 190, 44.70% of the individuals identified as male, 52.6% identified as female, and 2.6% identified as other. Regarding marital status, 98.4% identified as never married, 0.5% identified as married, and 1.1% identified as divorced or had marriage annulled. For racial/ethnic origin, 83.7% identified as White, 11.6% identified as Black or African American, 8.9% identified as Hispanic or Latino, 3.2% identified as Asian, 2.1% identified as American Indian or Alaska Native, and 0.5% identified as other. Individuals were given the option to select more than one race or ethnicity.

Measures

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a 36-item self-report measure of emotion regulation (Gratz & Roemer, 2004). The questionnaire measures six factors of emotion regulation including Nonacceptance of Emotional Responses, Difficulty Engaging in Goal-Directed Behavior, Impulse Control Difficulties, Lack of Emotional Awareness, Limited Access to Emotion Regulation Strategies, and Lack of Emotional Clarity. Items are endorsed on a 5-point scale in measuring the frequency of emotion regulation behaviors, beliefs, or experiences with response options ranging from 5 ("Almost always") to 1 ("Almost never"; Goldstein et al., 2020). In recent literature, there has been debate in utilizing the DERS item or shortened versions of the measure such as the 16-item (Bjureberg et al., 2015) or the 18-item (Victor & Klonsky, 2016). Due to the nature of this study, the DERS item measure is utilized to capture the full scope of emotion regulation strategies to better relate the measured factors pertaining to ER. The DERS items are included in Appendix A.

Responses for the DERS were separated into their respective subscale out of the six subscales identified in Gratz and Roemer (2004). Items 1, 2, 6, 7, 8, 10, 17, 20, 22, 24, and 34 values were reverse-scored so that a lower score represented higher dysregulation. After reverse-scoring the before listed items, the subscales and total scale variables for the DERS were calculated by the following: items 11, 12, 21, 23, 25, and 29 were summed for the Nonacceptance of Emotional Responses subscale total score; items 13, 18, 20, 26, and 33 were summed for the Difficulty Engaging in Goal-Directed Behavior subscale total score; items 3, 14, 19, 24, 27, and 32 were summed for the Impulse Control Difficulties subscale total score; items 2, 6, 8, 10, 17, and 34 were summed for the Lack of Emotional Awareness subscale total score; items 15, 16, 22, 28, 30, 31, 35, and 36 were summed for the Limited Access to Emotion Regulation Strategies subscale total score; and items 1, 4, 5, 7, and 9 were summed for the Lack of Emotional Clarity subscale total score. Finally, the Total Score for the

DERS was calculated by summing all six subscale total scores together. Higher values for both the subscales and total scores may indicate increased difficulty understanding emotional responses and access to emotion regulation strategies (Gratz & Roemer, 2004).

Gratz and Roemer (2004) report internal consistency (Cronbach's alpha) values in their original sample to be $\alpha > .80$ for all scales. Cronbach's α was calculated to determine the internal consistency of the DERS items for the present study. Results from a reliability analysis indicate good internal consistency DERS between all 36 items ($\alpha = .86$). Inter-item correlations ranged from $r = -.58$ to $r = .79$. The following results indicate the internal consistency among the DERS subscales: the Nonacceptance of Emotional Responses scale consisted of six items, ($\alpha = .92$); the Difficulties Engaging in Goal-Directed Behavior scale consisted of five items ($\alpha = .60$); the Impulse Control Difficulties scale consisted of six items ($\alpha = .67$); the Lack of Emotional Awareness scale consisted of six items ($\alpha = .87$); the Limited Access to Emotion Regulation Strategies consisted of eight items ($\alpha = .82$); the Lack of Emotional Clarity scale consisted of five items ($\alpha = .15$). See Table 3 for correlations of subscales. In comparision to the Gratz & Roemer (2014) internal consistency of $\alpha > .80$ for all scales, in the present study of the DERS scales the Difficulties Engaging in Goal-Directed Behavior scale, the Impulse Control Difficulties scale, and the Lack of Emotional Clarity for the present study all had lower internal consistency.

Minnesota Multiphasic Personality Inventory-3 (MMPI-3)

The MMPI-3 (Ben-Porath & Tellegen, 2020a) contains 335 items comprising 10 validity and 42 substantive scales organized in a hierarchical manner. Items on the MMPI-3 are presented with a true/false response format. The MMPI-3 has shown good reliability across settings and construct validity across numerous samples from different settings (Ben-Porath & Tellegen, 2020b; Brown & Sellbom, 2021). Criteria for a valid MMPI-3 protocol followed the guidelines as indicated by Ben-Porath, Y. S. & Tellegen, A. (2020a) which includes six validity scales for which if a certain cutoff is

reached indicates the protocol is invalid. If a participant's responses reached any one of the following cutoffs, their protocol was considered invalid: if the Cannot Say score (CNS) ≥ 15, if the Combined Response Inconsistency (CRIN) scale ≥ 80, if the Variable Response Inconsistency (VRIN) scale ≥ 80, if the True Response Inconsistency (TRIN) scale ≥ 80, if the Infrequent Responses (F) scale ≥ 100, or if the Infrequent Psychopathology Responses (Fp) scale ≥ 100.

Mesa Digit Span (Forward and Backward)

The Mesa Digit Span (WAIS-III; Wechsler, 1997) task consists of 30 items total, with a set of items related to the forward section of the task (16-items total) and another set of items related to the backwards section of the task (14-items total; See Appendix B). Participants are given the forward task first where they were asked to listen to a series of numbers read aloud by the researcher then asked to repeat the numbers they heard back to the researcher. For both the forward and backward section of the task, the items are grouped in pairs of 2 and if a participant answers incorrectly to both items for the pair, the task would be discontinued. Researchers conduct this task reading the numbers at a rate of one number per second. Digit Span Forward and Digit Span Backward were considered as separate tasks for data analyses.

Iowa Trail Making Test (A & B)

The Iowa Trail Making Test (Lezak et al., 2004) consists of two different versions, part A and B (See Appendix C). For part A, the participants are given instruction to draw a continuous line, without lifting their writing utensil, starting at the circled number one and going in numerical order until they reach the end number of 25. For part B, participants are given the instruction to again draw a continuous line between the circles without lifting their pen; however, they are told to alternate between going in numerical and alphabetical order. For instance, in starting the task they would draw a continuous line from one to 'A' to two to 'B' and so on. If the participant were to make an error while drawing their line, the researcher would stop the participant from continuing and instruct them

to go back to the last circle before the error occurred and continue the task. For both part A and B, participants are given an example of the task with the researcher showing how to work through the task before moving to the item for both A and B. Trails A and B were considered as separate tasks for data analyses.

FAS (Phonemic Fluency)

For this task (Tombaugh et al., 1999), participants are asked to list as many different words as they can think of that start with 'F', 'A', 'S'. Researchers instructed participants of two rules that they must follow when thinking of words to list. The first rule states that participants cannot use any proper nouns (e.g., names of people or company names). The second rule states that participants cannot use alternate forms of the same word (e.g., table and tables; unique and uniquely). Participants have one minute for each letter to list as many different words as they can. Researchers allocate one point to each different word the participant states that follows the rules listed above for each letter.

Animal Naming (Semantic Fluency)

In this task (Tombaugh et al., 1999), each participant is instructed to name as many different animals as they can think of within one minute. Researchers score each response one point to each different animal that the participant lists.

Clock Drawing Task

For this task participants were asked to draw, to the best of their ability, an analog clock with the time showing at 10 past 11. Scoring for this task was based on the Wechsler Memory Scale 4th edition (WMS-IV; Wechsler, 2009).

Procedure

Participants were scheduled through SONA in small groups (1-12 people per session). Each session had up to three trained graduate-student researchers present to conduct individual administration of EF tasks to each participant. A lab administrator and/or trained graduate student was always present for the participant(s) completing the Qualtrics section of the study on provided computers. Each participant received a physical copy of the Informed Consent Form, as well as a verbal explanation of the study and informed consent by the researcher and/or administrator for the study sessions. Researchers randomly selected participants at different intervals of time to be taken to a private, quiet individual room to complete the EF performance-based tasks. All questionnaires (e.g., DERS and MMPI-3) were completed via Qualtrics. Participants were chosen using simple randomization at different times to complete the performance-based tasks (e.g., FAS, Animal Naming, Clock Drawing, Iowa Trail Making Test (A & B), and Mesa Digit Span), which were administered to each participant by the administrator of the performance-based tasks in whichever order the administrator chose to conduct the assessments.

In scoring the performance-based measures, both Digit Span tasks were scored by assigning one point for each item correct. Both Trails A and Trails B were calculated in seconds, with lower times indicative of better performance on the task. For both the FAS and Animals task, participants were given one point for correct, non-repeated, responses and received a total score for all valid responses. Responses were written down and determined by trained graduate students as valid responses or not.

Analyses

While calculating the appropriate scores for the performance-based measures, the clock drawing task became difficult to score based on the Wechsler Memory Scale-IV scoring protocol. Both observations of the participant's performance during the task and *post hoc* analysis of the clock drawings indicated that more than 20 individuals were unable to draw an analog clock, let alone understand the directions for the specific time. Therefore, the entirety of the clock drawing task was excluded from the analyses, as it could not be determined if analyzing the clocks would appropriately measure an aspect of EF rather than general knowledge of an analog clock.

Bivariate Correlations.

For the analysis of the associations between the MMPI-3 and the performance measures, bivariate correlations were conducted using SPSS. The second goal for this study, correlating the DERS and performance-based measures, was conducted by using SPSS utilizing a bivariate correlational analysis. For this study, individuals with missing items for the DERS were excluded from the analysis using the listwise deletion function resulting in $n = 187$, which excluded an additional three participants from $n = 190$. Additionally, bivariate correlational analyses were conducted between the six performance-based measures. For all correlation analyses, the Pearson's r coefficient was utilized for significance cutoffs and each correlation analysis was run as a two-tailed analysis. Given the complete absence of any shared method variance, and the history as noted above of a lack of correlation between performance-based and self-report measures of EF specifically, generally small correlation coefficients are expected. Thus, considering as well the exploratory nature of this study, it was chosen to interpret potentially meaningful correlation coefficients $\geq |.15|$. This is somewhat more rigorous than Cohen's (1992) characterization of .10 as a small effect size, and it has been recommended as the threshold for interpretation in previous research facing similar constraints (for example see Graham et al., 1999, and especially Sellbom et al., 2007). We feel that effect size is a

more appropriate criterion in this exploratory context, though we acknowledge that there is no explicit control for Type I error. Probability level will differ based on variation of the two variables in each correlation coefficient, but across the correlations in this study the *r* value of .15 corresponds generally to a *p*-level of .05. Given that there are 252 correlation coefficients presented in Table 4, it is likely that at least 12.5 of them would have reached this level by chance. Thus, we recommend focusing on the pattern of results rather than on outliers.

Exploratory Factor-Analysis (EFA)

MPlus (version 8.0) was used to perform the exploratory factor analysis for the remaining six performance-based measures (Digit Span Forward, Digit Span Backward, Trails A, Trails B, FAS, and Animals) to explore their factor structure and potential relation to the Diamond (2013) model of EF. First, an open model was run to explore eigenvalues. In exploring the model fit for the EFA, the recommendations presented in Hu and Bentler (1999) were used to determine model fit for the different factor models. Per Hu and Bentler (1999), good fit for a factor analysis is indicated when (1) root-mean-square error of approximation (RMSEA) ≤ .06; (2) Comparative Fit Index (CFI) and Tucker Lewis Index(TLI) ≥ .95; and (3) standardized root mean square residual (SRMR) ≤ .08.

CHAPTER 3: RESULTS

Performance-Based Measures

Table 1 presents the means and standard deviations for performance-based measures. One set of descriptive statistics includes the entire sample of 190, and a second set of descriptive statistics includes the slightly smaller sample (n = 187) without missing DERS data. The results of the two-tailed bivariate correlations between the six performance-based measures are shown in Table 2 using the n = 190 sample of participants.

MMPI-3 Associations with Performance-Based Measures

For the correlational analyses between the MMPI-3 scales and performance-based measures (see Table 4), participants' Digit Span Forward scores were negatively correlated with the Self-Doubt scale, r = -.15; therefore, those who scored lower on Digit Span Forward had a higher score on the Self-Doubt scale. Trails A was positively correlated with both the Low Positive Emotions scale (r = .16) and the Disaffiliativeness scale (r = .17), while it was negatively correlated with the Dominance scale (r = -.16). In other words, those who took longer to complete Trails A scored higher on the Low Positive Emotions scale and the Disaffiliativeness scale, but those who took a shorter amount of time to complete Trails A scored higher on the Dominance scale on the MMPI-3. Trails B was negatively correlated with the Compulsivity scale (r = -.17) indicating that those who took longer to complete Trails B scored lower on the Compulsivity scale.

Total FAS score and the Emotional/Internalizing score were negatively correlated, r = -.15. Additionally, the total FAS score was negatively correlated with the Somatic Complaints scale (r = -.16), the Shyness scale (r = -.17), and the Introversion/Low Positive Emotionality scale (r = -.15). In other words, participants who have a lower total score on FAS had a higher scores on the Emotional/Internalizing, Somatic Complaints, Shyness, and Introversion/Low Positive Emotionality

scales. The Animals total score was positively correlated with the Hypomanic Activation scale (r = .16) indicating that those who scored a higher total score on Animals had a higher score on the Activation scale. All other correlation values between the MMPI-3 and the performance-based measures are shown in Table 4.

DERS Association with Performance-Based Measures

After analyzing the two-tailed bivariate correlations using a listwise deletion, three participants were excluded for the correlation (n = 187). Descriptive statistics for the DERS total score and subscales scores are shown in Table 5.

After correlating all six subscales of the DERS, the DERS total score, and the six performance-based measures, the two-tailed bivariate correlations indicated no meaningful correlations between any of the scales and the performance-based measures. The results of the correlations are shown in Table 6.

Exploratory Factor Analysis of the Performance-Based Measures

When conducting the exploratory factor analysis, eigenvalues were examined. The first eigenvalue was 2.133, the second eigenvalue was 1.226, and the third eigenvalue was 0.995 (See Figure 1). Based on the eigenvalues, the data likely indicated a one- or two-factor solution.

Results from the one-factor EFA model indicated a generally poor model fit, $\chi^2(9) = 56.32$, p = .00, CFI = .69, TLI = .48, RMSEA = .17 (90% CI = 0.13 – 0.21), SRMR = .09. Modification indices (MI) were examined to identify item (performance-based tasks) and parameter changes to improve model fit. The MI suggested including the following correlated residuals: Digit Span Forward with Digit Span Backward (MI = 17.84), Trails A with Trails B (MI = 27.07), and FAS with Animals (MI = 24.37). These correlations were made based on the modification indices from MPlus, with MI ≥ 10 indicating improved model fit, to help account for method variance in the one-factor revised model. However, the revised one-factor model was just identified, indicating that the model fit

indices are not interpretable, $\chi^2(6) = 3.96$, $p = .68$, CFI = 1.00, TLI = 1.00, RMSEA = .00 (90% CI = 0.00 – 0.07), SRMR = .02. Results from the two-factor model indicated a poor model fit, $\chi^2(4) = 28.47$, $p = .00$, CFI = .84, TLI = .39, RMSEA = .18 (90% CI = 0.12 – 0.24), SRMR = .05. The model fit indices are shown in Table 7. The standardized factor loadings for the EFA models are presented in Figure 2 for the one-factor revised model after inclusion of the correlated residuals. For the one-factor revised model the correlations between Digit Span Forward and Digit Span Backword $r = .25$, Trails A with Trails B $r = .35$, and FAS with Animals $r = .34$.

CHAPTER FOUR: DISCUSSION AND LIMITATIONS

Discussion

The purpose of this study was to investigate associations between popular performance-based measures of EF and self-report measures of emotion regulation. The study was exploratory in nature. As the MMPI-3 has been recently released, at the time this study was conducted there was no documented research relating performance-based measures to the constructs evaluated by the MMPI-3. When first looking at the variables, it was thought that correlations between the performance-based measures and the Emotional/Internalizing scales would be predominately correlated together. However, the only emotional functioning (internalizing) scales that had a meaningful correlation was the Low Positive Emotions scale, the Self Doubt scale, and the Compulsivity scale. As a few of the internalizing scales had a meaningful correlation with different performance-based measures, a certain degree of internalizing constructs could be related to or affecting performance on EF tasks that needs to be accounted for in the clinical setting. Previous research has supported that emotional internalizing factors may cause some degree of poorer performance on EF tasks, such as constructs related to anxiety or depression (Ajilchi & Nejati, 2017; Alves et al., 2014). Additionally, we did expect correlations between the scales of Hypomanic Activation and Activation, though they only correlated with the Animals task.

Furthermore, no meaningful correlations were found between the Neurological Complaints or the Cognitive Complaints scale with any of the performance-based measures. As indicated earlier, previous research has shown that self-report measures of EF and performance-based measures are often weakly associated or not associated with each other (Toplak et al., 2012). The results from this study, regarding the first goal, hold a similar indication as self-reported scores of Cognitive Complaints measured through the MMPI-3 were not meaningfully correlated to any of the six

performance-based measures. This result may provide support for the argument made by Donders and Strong (2016) and Løvstad et al. (2016) that self-reported measures of EF may be related to some other construct of emotional regulation. Although, for the present study, correlations were not found between the DERS and the performance-measures of EF, which argues against the claim made by Donders and Strong (2016) and Løvstad et al. (2016). However, due to the poor internal consistency for the DERS indicated in this study, future research needs to evaluate this claim further through the utilization of the DERS and different variations thereof such as the 16-item (Bjureberg et al., 2015) or the 18-item (Victor & Klonsky, 2016). Though more than likely, given the extensive research between self-report measures of EF and performance-based measures, the measures are uncorrelated and measuring different constructs entirely.

Furthermore, the meaningful correlations between the Trails A task, the FAS task, three of the interpersonal scales (Dominance, Disaffiliativeness, and Shyness), and the Introversion/Low positive Emotionality scale was an unexpected result. The results may indicate that individuals with higher scores on scales related to interpersonal dysfunction may have difficulty performing tasks with assessors in the room or in-person contact. Therefore, future studies should investigate the effect that interpersonal differences have when assessing performance measures of EF. Additionally, while the correlation values are generally low, considering the lack of method variance between the performance tasks, the correlations found with significance indicate meaningful correlations. Though, it should be noted that the meaningful correlations could be due to a Type I error rather than indicative of a meaningful pattern of results. There would be expected to be a more consistent pattern of results in the correlations between MMPI-3 scales and multiple performance-based outcomes before inferring a relationship. From a clinical standpoint, the results from this study indicate that there may be value in utilizing measures of psychopathological dysfunction, such as the MMPI-3, when assessing for factors pertaining to executive dysfunction for clients as the correlations presented

in this study indicate that a wide array of scales measuring psychological dysfunctioning by the MMPI-3 could be related to the performance on the EF tasks. The present study suggests potential associations between the EF tasks and certain scales related to interpersonal functioning, emotional/internalizing dysfunction, and externalizing. Although at the time this study was conducted, no studies evaluating performance-measures and the MMPI-3 have been made public. However, as indicated earlier previous research has shown a connection to different constructs such as internalizing psychopathology (Ajilchi & Nejati, 2017; Alves et al., 2014). Future research should continue to investigate the strength of the relationships between the self-reported measures of executive dysfunctions and psychopathological dysfunction for potential connections between the two constructs that could assist future clinicians in assessment of clients.

Current research related to EF has attempted to implement connections between emotion regulation, or emotions in general, and how the processes relate to EF (Salehinejad et al., 2021). The second goal of this study aimed to evaluate the association between popular EF measures and the scales from the DERS questionnaire (Gratz & Roemer, 2004). While no meaningful correlations were determined in this study, this could indicate a few possibilities. First, there may be more to explore within the construct of EF that may not be assessed through the specific performance-based measures utilized in this study. Salehinejad et al. (2021) posits that certain EF constructs may be more affected by emotion processes than others (i.e., the "hot" and "cold" domains for EF). Therefore, future studies should investigate different performance-measures, including the ones utilized in this study, and their relationship to self-reported measures of internalizing factors or emotion regulation processes.

Finally, the third goal of this study aimed at identifying one or more latent factors of the six performance-based measures of EF. Diamond (2013) indicated three primary constructs of EF, which included inhibitory control, cognitive flexibility, and working memory. It was determined through this study that the measures used were incapable of forming a good model fit for the two-factor model, let

alone the three-factor model. Therefore, these results do not support the Diamond (2013) model of executive functioning based on the final six performance-based measures utilized in this study (Digit Span Forward & Backward, Trails A & B, FAS, and Animals). However, this study was limited in the degree to which the model proposed by Diamond (2013) could be explored using an exploratory factor analysis. To combat the limitations, future research should examine the utility of different performance-based measures for EF to adequately address the method variance between the performance measures and potentially determine if certain performance measures are better suited towards assessing the different constructs of EF than others. For instance, in the future, while still a popular assessment, the clock drawing task may become obsolete. In the current study, the clock drawing task was excluded due to the abundance of the participants being unable to draw an analog clock without the provision of prompts by the test administrators. One reason for this result may be that the analog clock has become a less popular or known tool for measuring time as opposed to the digital clock. A qualitative study could be used to inform clinicians and researchers about the general population's knowledge on this matter, though no recent studies were found to indicate this. If evidence is found to support this hypothesis, there may be a need continually re-evaluate the measurements utilized for EF assessments if general knowledge changes with time.

Overall, there is evidence within this study to support that internalizing factors may affect overall performance measures of EF. However, self-reported measures of EF still need to be evaluated to ascertain the differing constructs that are being assessed through self-report as opposed to actual performance-based measures of EF. While both may provide useful clinical utility, it is entirely possible that the different measurement styles of assessing EF could be affected by other factors, such as internalizing or emotional factors, that need to be accounted for in future research endeavors.

Limitations

This study is not without limitations. In conducting the EFA, there were not enough indicators (performance-based measures) to successfully conduct the EFA. Additionally for this study, the EF tasks shared too much method variance, which limited ability to conduct an exploratory factor analysis as the analytic tool, MPlus, indicated correlated residuals would improve model fit. The intercorrelations between the similar tasks (i.e. Digit Span Forward and Digit Span Backward) influenced the overall results of the EFA. Furthermore, the metrics of the performance measures themselves limit the ability to factor the performance-tasks into one factor or into different factors. For example, Trails A and Trails B are measured using reaction times while the FAS and Animals tasks are calculated by number of items recalled in one minute. Due to the limited idicators, shared method variance, and differences in scales being measured between the indicators, an EFA was not possible for the present sample. In future iterations of this method of research, more EF tasks should be included to account for the shared method variance and differences in measurement styles. Another unexpected limitation of the study resulted from many participants in the sample being unable to produce measurable and/or scorable portrayals of an analog clock for the clock drawing task that could be scored based on the WMS scoring criteria. The conclusion to exclude the entire clock drawing task was due to the inability to designate if poor performance on the task was due to difficulties in EF for the respective participants or a general lack of knowledge on the steps needed to construct an analog clock. While performing the clock drawing task, many individuals requested a definition of an analog clock, which they were then prompted by the assessor as “the clock with the hands.” One explanation for the poor performance on the clock drawing task could be due to an increased reliability of digital clocks rather than analog clocks, especially with a younger population. Future studies should evaluate the reliability and validity of the clock drawing task as an appropriate measure for EF younger generations continue to utilize digital rather than analog clock

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TABLES

Table 1

Means and Standard Deviations for Performance Measures

Performance Measures	Sample One for MMPI-3 Analysis		Sample Two for DERS Analysis	
	M	*SD*	*M*	*SD*
Digit Span Forward Total	10.13	2.14	10.11	2.14
Digit Span Backward Total	6.46	1.83	6.49	1.83
Trails A (seconds)	25.89	10.35	25.83	10.29
Trails B (seconds)	51.54	19.78	51.28	19.46
FAS Total	33.60	9.61	33.83	9.44
Animals Total	22.26	4.92	22.36	4.78

Note. For Sample One, $n = 190$; For Sample Two, $n = 187$.

Table 2

Correlations Between Performance-Based Measures

Performance-Based Measures	Correlations				
	1	2	3	4	5
1. Digit Span (DS) Forward					
2. Digit Span (DS) Backward	.484**				
3. Trails A	-.150**	-.252**			
4. Trails B	-.229**	-.234**	.444**		
5. FAS Total	.160*	.178*	-.023	-.079	
6. Animals Total	.173*	.218**	-.133	-.181*	.405**

Note. * indicates $p < .05$; ** indicates $p < .01$.

Table 3

Correlations Between Six Subscales on DERS Measure

Subscales for the DERS	Correlations				
	1	2	3	4	5
1. Nonacceptance of Emotional Responses					
2. Difficulties Engaging in Goal-Directed Behavior	.516**				
3. Impulse Control Difficulties	.604**	.480**			
4. Lack of Emotional Awareness	-.260**	.004	-.117		
5. Limited Access to Emotion Regulation Strategies	.700**	.639**	.709**	-.152*	
6. Lack of Emotional Clairity	.398**	.373	.378**	.121	.449**

Note. *Ns* = 191-192; ** indicates $p < .01$; * indicates $p < .05$.

Table 4

Correlations Between MMPI-3 Scales and Performance-Based Measures

MMPI-3 Scales	Performance-Based Measures					
	DS Forward	DS Backward	Trails A	Trails B	FAS Total	Animals Total
RC1-Somatic Complaints	-.025	-.106	.063	.045	-.103	-.150*
MLS-Malaise	-.028	-.006	.114	.048	-.048	.005
NUC-Neurological Complaints	-.056	-.088	-.032	-.002	-.021	-.041
EAT- Eating Concerns	-.135	-.092	-.087	.043	-.142	-.089
COG-Cognitive Complaints	.039	.070	.071	.044	.006	.077
EID-Emotional/Internalizing Dysfunction	-.105	-.027	.114	.045	-.144	-.078
RCd-Demoralization	-.110	-.005	.088	.038	-.102	-.034
SUI-Suicidal/Death Ideation	-.090	.016	.030	-.030	.050	.106
HLP-Helplessness/Hopelessness	-.135	.028	.113	-.001	-.075	-.134
SFD-Self Doubt	-.148*	.019	.082	.038	-.084	-.008
NFC-Inefficacy	-.070	-.004	.094	.099	-.073	-.105
RC2-Low Positive Emotions	-.078	.032	.159*	-.076	-.163*	-.124
INTR-Introversion/Low Positive Emotions	-.048	.078	.140	.113	-.147*	-.073
RC7-Dysfunctional Negative Emotions	-.036	-.058	.026	-.073	-.110	-.036
STR-Stress	-.074	-.087	.067	.092	-.074	-.027

WRY-Worry	-.052	.004	.071	.042	-.086	-.047
CMP-Compulsivity	.094	.112	-.068	-.166*	.029	-.083
ARX- Anxiety Related Experiences	-.088	-.067	.076	.107	-.086	-.101
ANP-Anger Proneness	-.013	-.077	-.009	-.109	-.063	-.061
BRF-Behavior Restricting Fears	.017	-.034	.022	.001	-.085	-.097
NEGE-Negative Emotionality	-.073	-.055	.088	.105	-.072	-.063
THD-Thought Dysfunction	.051	-.014	-.021	-.051	.029	.030
RC6-Ideas of Persecution	-.017	.010	.090	-.011	.038	.018
RC8-Abberant Experiences	.027	.001	-.049	-.024	.037	-.010
PSYC-Psychoticism	.038	-.046	-.049	-.049	.034	.023
BXD-Behavioral External Dysfunction	.044	-.003	.018	-.011	.040	.100
RC4-Antisocial Behavior	.086	.057	.041	.026	.038	.002
FML-Family Problems	.023	.010	.017	.039	-.104	-.008
JCP-Juvenile Conduct Problems	.016	.060	-.004	.057	.024	-.046
SUB-Substance Abuse	.017	-.080	.103	.027	-.031	.043
RC9-Hypomanic Activation	.062	-.029	-.076	-.092	.102	.165*
IMP-Impulsivity	-.034	-.036	-.004	-.077	-.047	.033
ACT-Activation	.059	-.056	-.103	-.044	.115	.156*
AGG-Aggression	.055	-.026	-.039	-.011	.009	.037
CYN-Cynicism	.013	.056	.053	.020	-.120	-.074
DISC-Disconstraint	.045	-.006	.070	.020	.004	.037
SFI-Self-Importance	.033	-.057	-.058	-.035	.039	.089

DOM-Dominance	-.069	.022	-.157*	-.072	.057	.091
AGGR-Aggressiveness	-.027	.021	-.122	-.088	.036	.089
DSF-Disaffiliativeness	-.057	-.010	.170*	.070	-.024	-.088
SAV-Social Avoidance	-.021	.086	.090	.097	-.142	-.086
SHY-Shyness	-.002	-.010	.066	.128	-.167*	-.109

Note. * indicates value ≥ |.15|.

Table 5

Means and Standard Deviations of the DERS Subscale and Total Scores

DERS Scales	*M*	*SD*
Nonacceptance of Emotional Responses	14.69	6.41
Difficulty Engaging in Goal-Directed Behavior	15.03	3.56
Impulse Control Difficulties	12.51	3.75
Lack of Emotional Awareness	13.29	2.47
Limited Access to Emotion Regulation Strategies	19.12	6.19
Lack of Emotional Clarity	13.29	2.47
Total Score	94.42	18.38

Note. Sample $n = 187$.

Table 6

DERS Total and Subscales Correlations with Performance-Based Measures

DERS Total Score and Subscales	Performance Measures					
	DS Forward	DS Backward	Trails A	Trails B	FAS Total	Animals Total
Total Score	-.041	-.064	.007	.052	-.007	-.009
Nonacceptance of Emotional Responses	-.069	-.031	.027	-.037	.027	-.020
Difficulty Engaging in Goal-Directed Behavior	.029	-.026	-.012	-.010	-.060	-.022
Impulse Control Difficulties	-.053	-.072	.068	.107	-.009	-.002
Lack of Emotional Awareness	.046	-.053	-.077	.042	.027	.066
Limited Access to Emotion Regulation Strategies	-.044	-.054	.038	.094	-.036	-.064
Lack of Emotional Clarity	-.063	-.044	-.017	.063	-.077	-.061

Table 7

Model Fit Index

Model	$\chi^2(df)$	CFI	TLI	RMSEA [90% CI]	SRMR
6 items—One-Factor	56.323 (9)*	.685	.475	.165 [.125 – .208]	.09
6 items—Two-Factor	28.472 (4)*	.837	.389	.178 [.120 – .24]	.05
6 items—One-Factor Revised	3.959 (6)	1.000	1.000	.000 [.000 – .073]	.02

Note. * indicates $p < .01$; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root-mean-square error of approximation; CI = Confidence interval; SRMR = standardized root mean square residual.

FIGURES

Figure 1

Scree-Plot of Eigenvalues for EFA

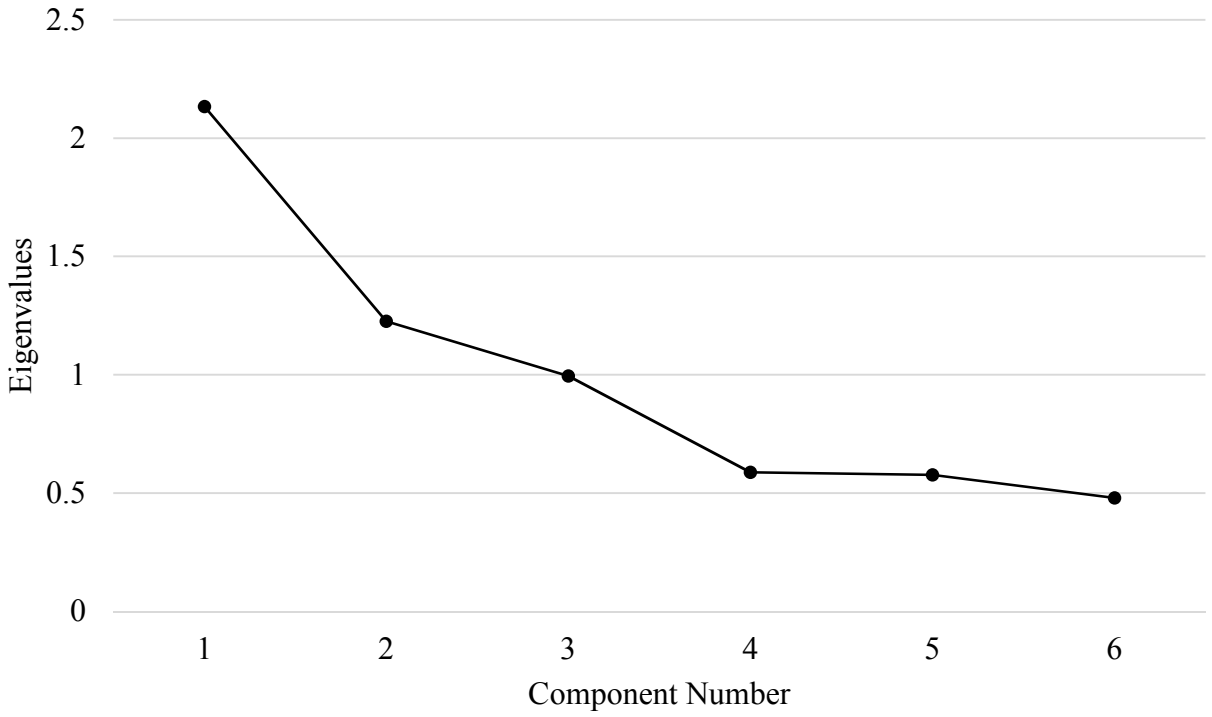
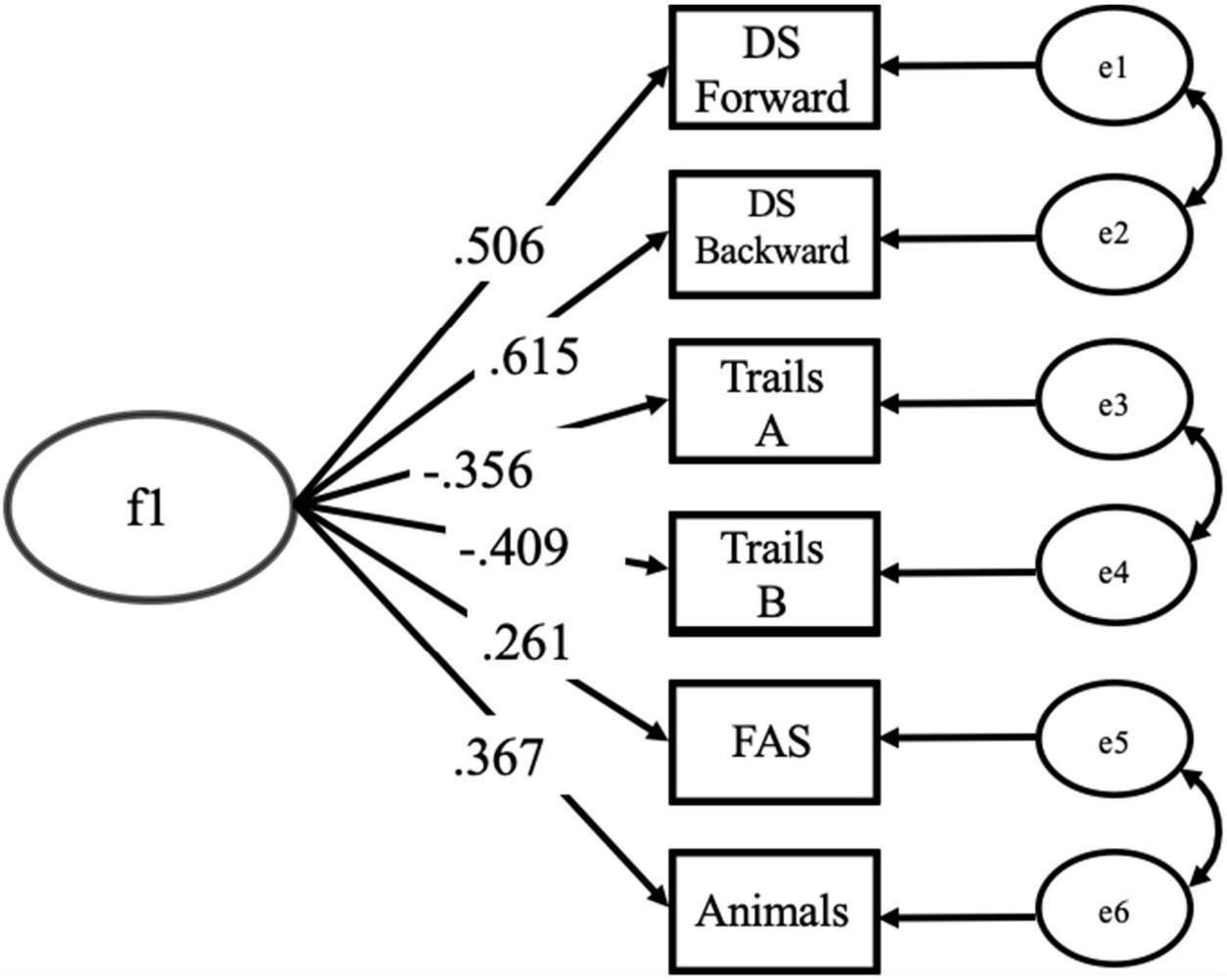


Figure 2

One-Factor Revised EFA Model Accounting for Correlated Residuals



Appendix A

DERS Questionnaire

Difficulties in Emotion Regulation Scale (DERS) Response categories:

1 Almost never (0-10%)

2 Sometimes (11-35%)

3 About half the time (36-65%)

4 Most of the time (66 – 90%)

5 Almost always (91-100%)

1. I am clear about my feelings.

2. I pay attention to how I feel.

3. I experience my emotions as overwhelming and out of control.

4. I have no idea how I am feeling.

5. I have difficulty making sense out of my feelings.

6. I am attentive to my feelings.

7. I know exactly how I am feeling.

8. I care about what I am feeling.

9. I am confused about how I feel.

10. When I'm upset, I acknowledge my emotions.

11. When I'm upset, I become angry with myself for feeling that way.

12. When I'm upset, I become embarrassed for feeling that way.

13. When I'm upset, I have difficulty getting work done.

14. When I'm upset, I become out of control.

15. When I'm upset, I believe that I will remain that way for a long time.

16. When I'm upset, I believe that I'll end up feeling very depressed.

17. When I'm upset, I believe that my feelings are valid and important.

18. When I'm upset, I have difficulty focusing on other things.

19. When I'm upset, I feel out of control.

20. When I'm upset, I can still get things done.

21. When I'm upset, I feel ashamed with myself for feeling that way.

22. When I'm upset, I know that I can find a way to eventually feel better.

23. When I'm upset, I feel like I am weak.

24. When I'm upset, I feel like I can remain in control of my behaviors.

25. When I'm upset, I feel guilty for feeling that way.

26. When I'm upset, I have difficulty concentrating.

27. When I'm upset, I have difficulty controlling my behaviors.

28. When I'm upset, I believe there is nothing I can do to make myself feel better.

29. When I'm upset, I become irritated with myself for feeling that way.

30. When I'm upset, I start to feel very bad about myself.

31. When I'm upset, I believe that wallowing in it is all I can do.

32. When I'm upset, I lose control over my behaviors.

33. When I'm upset, I have difficulty thinking about anything else.

34. When I'm upset, I take time to figure out what I'm really feeling.

35. When I'm upset, it takes me a long time to feel better.

36. When I'm upset, my emotions feel overwhelming.

Appendix B

Mesa Digit Span Forward & Backward

DIGIT SPAN TEST - - *FORWARD*

- After saying the instructions administer the digit spans in order. Do not repeat a span once read.
- Administer both spans of the same length regardless of how the participant performs. Say the digits at a rate of
- 1 digit about every 1 sec.
- Use a monotonic voice; without inflections at the end
- Discontinue after failure on both trials of any item (e.g., 5a and 5b)

Examiner: *"I am going to say some numbers. Listen carefully, and when I am through say them right after me. For example, if I say 7-1-9, what would you say?"*

- If the participant responds correctly (7-1-9), say: *"That's right,"* and proceed to Item 1.
- If the participant fails the example, say: *"No, you would say 7-1-9. I said 7-1-9, so to say it forwards you would say 7-1-9. Now try these numbers. Remember, you are to say them forwards. 3-4-8."*
- Whether the participant succeeds or fails with the second example (3-4-8), proceed to Item 1. Give no help on this second example or any of the items that follow.

Scoring: Each span is scored '1' (Pass) or '0' (Fail). Only discontinue test when participant has failed both trials of the same span length (e.g., 5a and 5b)

Item	Digit Span	Pass	Fail
1 a.	1 - 7	○ 1	○ 0
b.	6 - 3	○ 1	○ 0
2 a.	5 - 8 - 2	○ 1	○ 0
b.	6 - 9 - 4	○ 1	○ 0
3 a.	6 - 4 - 3 - 9	○ 1	○ 0
b.	7 - 2 - 8 - 6	○ 1	○ 0
4 a.	4 - 2 - 7 - 3 - 1	○ 1	○ 0
b.	7 - 5 - 8 - 3 - 6	○ 1	○ 0
5 a.	6 - 1 - 9 - 4 - 7 - 3	○ 1	○ 0
b.	3 - 9 - 2 - 4 - 8 - 7	○ 1	○ 0
6 a.	5 - 9 - 1 - 7 - 4 - 2 - 8	○ 1	○ 0
b.	4 - 1 - 7 - 9 - 3 - 8 - 6	○ 1	○ 0
7 a.	5 - 8 - 1 - 9 - 2 - 6 - 4 - 7	○ 1	○ 0
b.	3 - 8 - 2 - 9 - 5 - 1 - 7 - 4	○ 1	○ 0
8 a.	2 - 7 - 5 - 8 - 6 - 2 - 5 - 8 - 4	○ 1	○ 0
b.	7 - 1 - 3 - 9 - 4 - 2 - 5 - 6 - 8	○ 1	○ 0

DIGIT SPAN TEST - - *BACKWARD*

- Administer the digit spans in order. Do not repeat a span once read.
- Administer both spans of the same length regardless of how the participant performs. Say the digits at a rate of 1 digit about every 1 sec.
- Use a monotonic voice; without inflections at the end

Examiner: *"Now I am going to say some numbers, but this time when I stop I want you say them backwards. For example, if I say 7-1-9, what would you say?"*

- If the participant responds correctly (9-1-7), say: *"That's right,"* and proceed to Item 1.
- If the participant fails the example, say: *"No, you would say 9-1-7. I said 7-1-9, so to say it backwards you would say 9-1-7. Now try these numbers. Remember, you are to say them backwards. 3-4-8."*
- Whether the participant succeeds or fails with the second example (3-4-8), proceed to Item 1. Give no help on this second example or any of the items that follow.
- Discontinue after failure on both trials of any item (e.g., 5a and 5b)

Scoring: Each span is scored '1' (Pass) or '0' (Fail). Only discontinue test when participant has failed both trials of the same span length (e.g., 5a and 5b)

Item	Digit Span	Pass	Fail
1 a.	2 - 4	○ 1	○ 0
b.	5 - 7	○ 1	○ 0
2 a.	6 - 2 - 9	○ 1	○ 0
b.	4 - 1 - 5	○ 1	○ 0
3 a.	3 - 2 - 7 - 9	○ 1	○ 0
b.	4 - 9 - 6 - 8	○ 1	○ 0
4 a.	1 - 5 - 2 - 8 - 6	○ 1	○ 0
b.	6 - 1 - 8 - 4 - 3	○ 1	○ 0
5 a.	5 - 3 - 9 - 4 - 1 - 8	○ 1	○ 0
b.	7 - 2 - 4 - 8 - 5 - 6	○ 1	○ 0
6 a.	8 - 1 - 2 - 9 - 3 - 6 - 5	○ 1	○ 0
b.	4 - 7 - 3 - 9 - 1 - 2 - 8	○ 1	○ 0
7 a.	9 - 4 - 3 - 7 - 6 - 2 - 5 - 8	○ 1	○ 0
b.	7 - 2 - 8 - 1 - 9 - 6 - 5 - 3	○ 1	○ 0

Appendix C

Iowa Trail Making Task (A & B)

Trail Making Test (TMT) Parts A & B

Instructions:

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

Step 1: Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil.

Step 2: Demonstrate the test to the patient using the sample sheet (Trail Making Part A – *SAMPLE*).

Step 3: Time the patient as he or she follows the “trail” made by the numbers on the test. Step 4: Record the time.

Step 5: Repeat the procedure for Trail Making Test Part B.

Scoring:

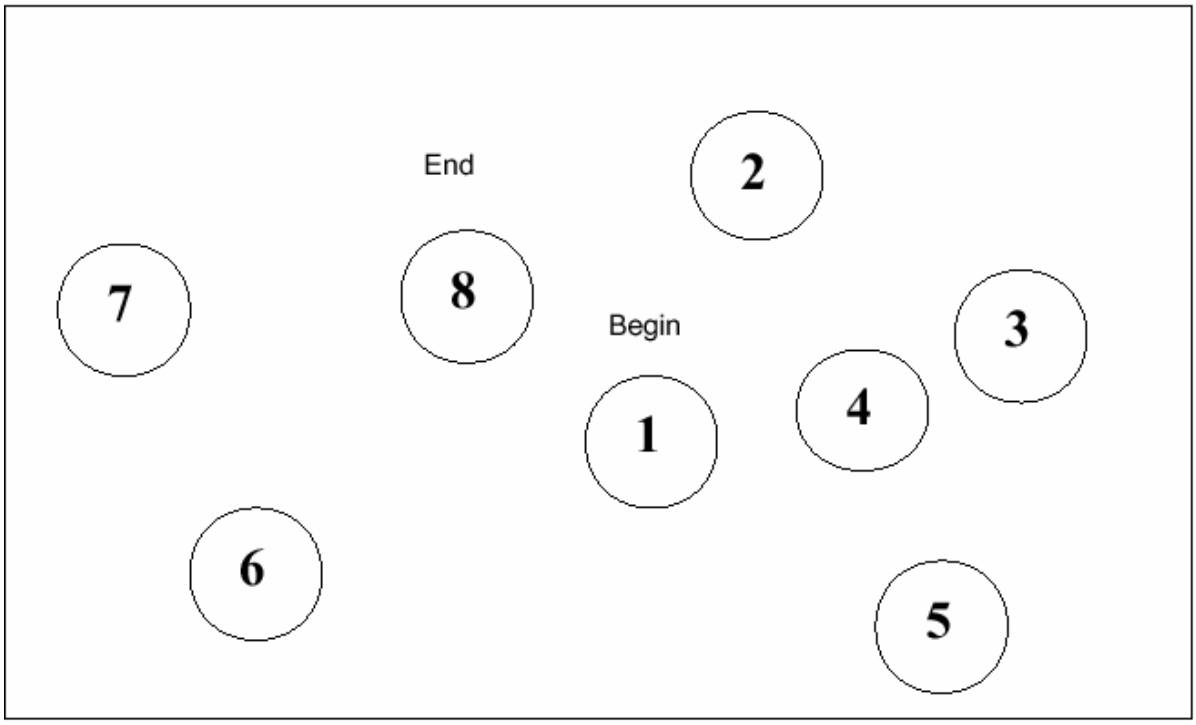
Results for both TMT A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

	Average	**Deficient**	**Rule of Thumb**
Trail A	29 seconds	> 78 seconds	Most in 90 seconds
Trail B	75 seconds	> 273 seconds	Most in 3 minutes

Sources:

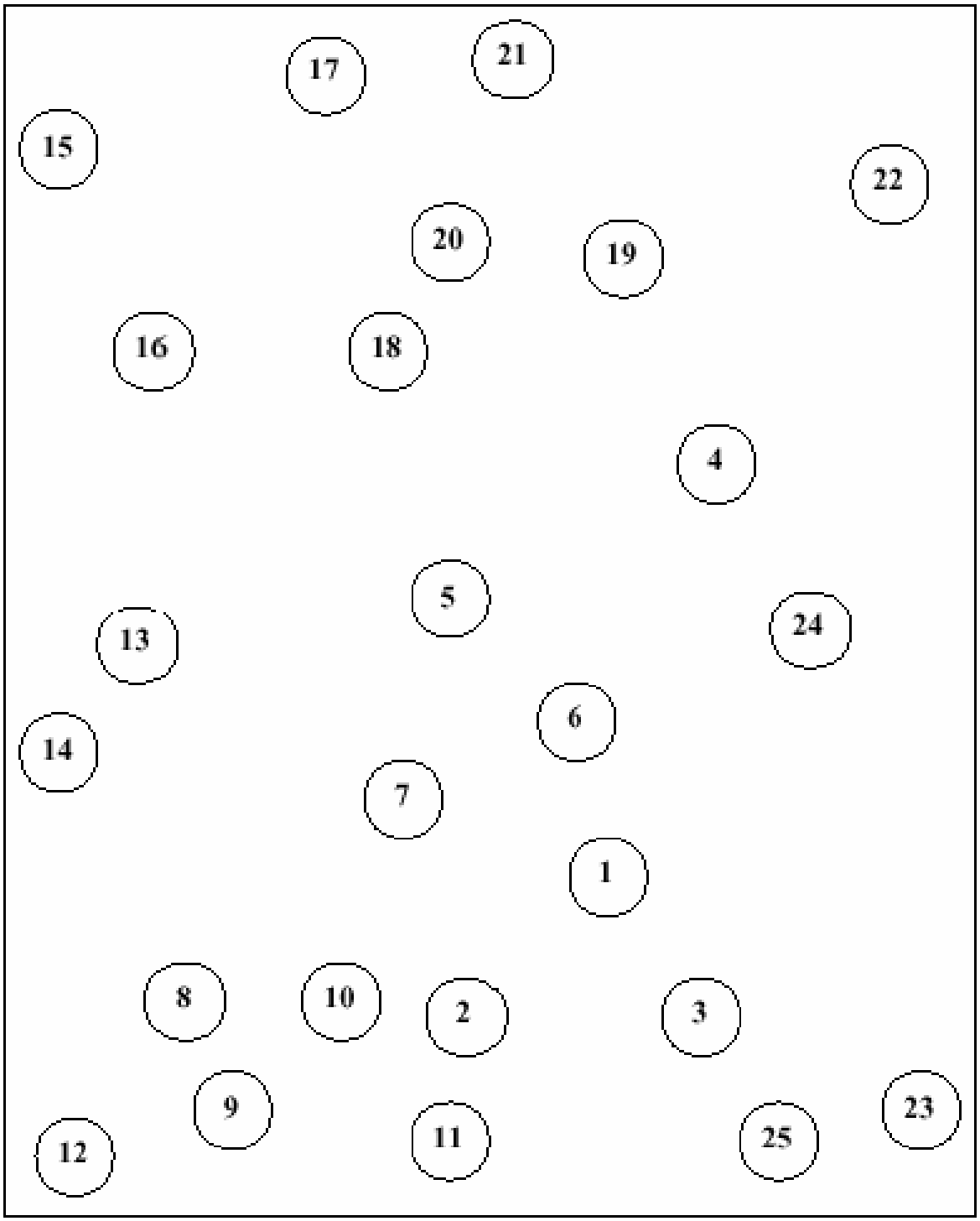
- Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J Clin Psychol*. 1987;43(4):402–409.
- Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol*. 1995;17(4):529-535.
- Lezak MD, Howieson DB, Loring DW. *Neuropsychological Assessment*. 4th ed. New York: Oxford University Press; 2004.
- Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills*. 1958;8:271-276.

Trail Making Test Part A – *SAMPLE*

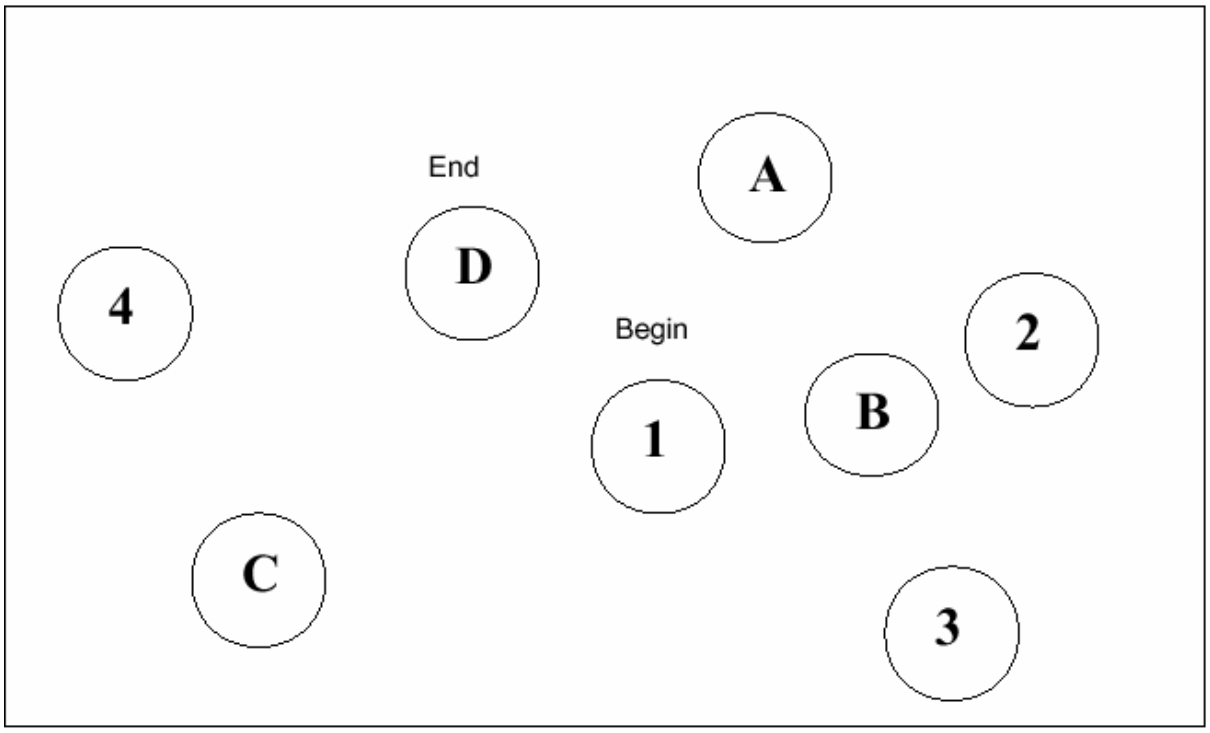


Trail Making Test Part A

Patient's Name:_____ Date: _____



Trail Making Test Part B – *SAMPLE*



Trail Making Test Part B

Patient's Name: _____ Date: _____