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## Utilizing a transdiagnostic neuroscience-informed approach to differentiate the components of a complex clinical presentation: A case report

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### Abstract

**Background:** Recent research recognizes considerable overlap in the clinical presentation of psychiatric disorders such as Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder and Social Anxiety Disorder. The diagnostic approach collects symptoms to reflect a single underlying psychopathological process. The Research Domain Criteria (RDoC) emphasizes psychopathology as arising from combinations of abnormalities in core underlying constructs that can be measured at many levels of analysis, from biological to behavioral. Patients who present with clinical heterogeneity may benefit from transdiagnostic case conceptualization that integrates detailed symptom information across multiple measurements spanning multiple domains of functioning based in the RDoC framework.

**Case presentation:** We report on one case that was included in a research study focused on advancing knowledge towards a transdiagnostic, brain-based model of anxiety and depression.

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#### Authors' contributions

Alicia B. Vanden Bussche drafted the manuscript, compiled references and created the table.

Nancy A. Haug integrated the clinical data, conceptualized the case, and wrote parts of the manuscript.

Tali M. Ball edited the manuscript and provided expertise on the integration of clinical and neurocognitive data, as well as the transdiagnostic conceptualization.

Claudia B. Padula offered neuropsychological expertise on the interpretation of measures.

Andrea N. Goldstein-Pierarski provided input on the interpretation of neurocognitive data and neural circuits.

Leanne M. Williams edited the manuscript, interpreted the findings and served as senior consultant on the case study conceptualization. She is the Principal Investigator of the research study referenced in this case report.

#### Authors' information

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#### Competing interests

There is no conflict of interest. WebNeuro is distributed by Brain Resource. LMW had no financial involvement in the company for the last three years.

The 20-year-old male patient presented at a community mental health clinic for inattention, low mood, sleep problems and anxious symptoms. The patient also presented with primary problems in negative valence systems (anxiety, avoidance, and bias towards negative information), cognitive systems (fluctuating cognitive ability over time, poor concentration and ability to focus), and social processing systems (deficits in social communication skills). Conceptualizing this case through a transdiagnostic lens augmented the patient's treatment plan by including a more integrative approach. Treatment included social skills training, progressive relaxation exercises, and basic psychoeducation in emotional expression and independent living skills.

**Conclusion:** This case illustrates the utility of a transdiagnostic approach, particularly when a traditional diagnostic model generates conflicting evidence and/or multiple comorbidities. RDoC provides a framework for integrating abnormalities across multiple dimensions. Furthermore, it lays the foundation for future integration of brain-behavior relationships into case conceptualization and personalized treatment approaches.

### Keywords

Research Domain Criteria (RDoC); Transdiagnostic; Differential; Diagnostic; Autism Spectrum Disorder

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### Background

Presenting psychopathology often does not fit neatly into our current diagnostic boundaries. An implicit assumption of the current diagnostic system is that the collection of particular symptoms reflects a single underlying psychopathological process. Complementing this approach, the Research Domain Criteria (RDoC) considers that complex clinical presentations arise from combinations of abnormalities in core underlying dimensions that can manifest across multiple levels of analysis, from biological to behavioral. From this RDoC lens, an adequate description of psychopathology relies on more than categorical collections of symptoms and provides direct links to a brain-based understanding of psychopathology.

The Research Domain Criteria (RDoC) framework, an initiative within the National Institute of Mental Health, aims to better understand basic dimensions of functioning underlying the full range of human behavior from normal to abnormal [1,2]. The RDoC framework consists of functional constructs (i.e. concepts representing a specified functional dimensions of behavior), and proposes behavioral paradigms, brain circuits, genes, and molecules that can be used to measure them [1]. Constructs are grouped into domains of functioning, which reflect current knowledge surrounding major systems of cognition, emotion, motivation, and social behavior. Currently, there are five domains in the RDoC matrix: 1) negative valence systems; 2) positive valence systems; 3) cognitive systems; 4) systems for social processes; 5) arousal [1,2].

In the present case report, we integrated clinical, neuropsychological, and neurocognitive behavioral measures for a complex case of a young man presenting with symptoms of Autism Spectrum Disorder (ASD), Social Anxiety Disorder (SAD), and Attention Deficit/

Hyperactivity Disorder (ADHD). We aimed to generate an integrated, transdiagnostic case conceptualization and use this conceptualization to develop a treatment plan.

Autism Spectrum Disorder is broadly described as markedly abnormal or impaired development in social interaction and communication, and is characterized by a restricted and stereotyped repertoire of activities and interests. Manifestations of autism vary, depending on age and level of development [3]. Children who are high-functioning (i.e., IQ within normal limits) and have milder presentations of ASD are less likely to be diagnosed until older childhood or beyond [4]. Diagnosis of ASD in this group can be complicated by clinical heterogeneity and comorbidity with other psychiatric disorders such as ADHD and SAD [5,6]. Similar to ASD, ADHD often involves difficulties with social interaction, communication, and restricted interests [7], while SAD can include social withdrawal, freezing or failing to speak in social situations.

Due to symptom overlap, these diagnostic categories may be a poor indication of the underlying pathology. In contrast, the negative valence systems, cognitive systems, and systems for social processes are key constructs that span ASD, ADHD, and SAD diagnoses. Thus, patients who have overlapping clinical presentations may benefit from an RDoC-informed, transdiagnostic assessment.

## Case presentation

### Presenting concerns

The patient is a 20-year-old, unemployed male from a high socioeconomic background living at home with his parents. The patient was brought to a community mental health clinic for psychological treatment by his parents, who were concerned about his mental health. He sought treatment to assist with distractibility, procrastination, and fidgeting behavior that he could not control. He described having angry outbursts and impulsive tendencies. He reported struggling with the above symptoms since 10 years of age. The patient endorsed significant social anxiety and social skill deficits that interfered with engagement in social interactions. He also reported low mood and frequent urination at night causing him discomfort and sleep disturbance.

### Developmental history

According to a psychosocial history and collateral reports, he was born approximately three weeks late and his delivery was difficult. He exhibited hydrocephalus and did not cry or move around. Developmental milestones were achieved at expected age levels and language milestones were achieved earlier than expected. As objectively reported by his family, he had a remarkable memory and a “fast brain.” However, he experienced a number of sensory and motor coordination issues that started during early childhood. He was disturbed by loud noises, heard sounds unrecognized by others, was bothered by clothing tags and sometimes chewed on erasers. He also had difficulty with balance and problems with his ankles rolling. He did not have friendships or significant close relationships, other than family members.

## Psychosocial history

The patient struggled academically and socially while away at college, which precipitated his leaving the university after two years. He had difficulty making friends and oftentimes worried that other individuals were ignoring him. Although he received adequate grades during his freshman year, he could not keep up with classes and described feeling as if his teachers were going too fast during lectures. He reported an inability to focus and complete schoolwork. The patient explained that nervousness about tests and grades tended to make his situation worse. After returning home, he had difficulty driving an automobile due to checking multiple directions before turning and fear of getting into an accident. He subsequently stopped driving altogether, leading to significant reliance on his parents.

## Mental status exam and cognitive screening

The patient was dressed casually and had appropriate hygiene. His behavior was odd, including hopping while walking and repeating the clinician's questions. He was fidgety and frequently stared at the floor. He had prolonged latency when speaking and thought processes were inhibited. It was unclear to the examiner if the patient was internally preoccupied or unable to focus due to attention deficits. Mood was apathetic, withdrawn, and slightly irritable. Affect was blunted and guarded. Judgment was fair, as evidenced by expressed interest in seeking help. Insight was fair, due to recognition of behaviors causing substantial impairment. His full scale IQ was in the average range, and he exhibited mild cognitive impairment on a cognitive screening measure.

## Diagnostic assessment

After six sessions of psychological treatment at the community health clinic, the patient's therapist diagnosed Social Anxiety Disorder, Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type, and Unspecified Neurodevelopmental Disorder. SAD was diagnosed based on the patient's excessive fear of scrutiny in social situations, strong fears that he may become panicked in public and social avoidance. Comorbid ADHD was based on the patient's inability to sustain attention, tendency to become easily distracted, procrastination, disorganization in his work habits, and difficulty paying attention to others; symptom onset occurred prior to age 11. Unspecified Neurodevelopmental Disorder was diagnosed based on the patient's additional impairments in social functioning that were not better accounted for by ADHD, ASD, or SAD. It was noted that his symptoms might have organic etiology related to hydrocephalus at birth or other neurological conditions; thus further evaluation and medical work-up was recommended. In addition, the therapist indicated that Internet Gaming Disorder should be ruled out, based on the patient's preoccupation with games on the internet, withdrawal symptoms when he did not play internet games, needing to spend more time playing Internet games in order to feel satisfied, and continuing to play games on the Internet despite knowledge that playing impacted his functioning. He reportedly enjoyed playing games where he had to identify the 'good' guys vs. the 'bad' guys.

## Neuropsychological assessment

Due to diagnostic complexity and unspecified neurodevelopmental disorder, the patient was referred to rule out ASD. He completed a full neuropsychological evaluation at approximately 10 weeks into treatment. His assessment scores were consistent with a diagnosis of Autism Spectrum Disorder (Level 1 without language or intellectual impairments); he performed poorly on assessments measuring sensory and motor functioning, executive functioning, verbal abilities, and social-emotional adjustment. Consistent with the diagnostic criteria for ASD, the patient showed: (1) persistent deficits in social communication and interaction across multiple contexts; (2) current and past hyper-reactivity to sensory input; (3) experienced these symptoms since childhood; (4) experienced clinically significant impairment across domains; (5) his performance on the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV) ruled out intellectual disability and global developmental delay (see Table 1).

## Neurocognitive behavioral assessment

Approximately four months after intake, the patient was assessed in the context of his participation in a research study [8]. The research assessment included a computerized neurocognitive battery known as “WebNeuro” [9,10]. Scores on this battery were in part inconsistent with his profile of neuropsychological performance. His scores on the WebNeuro assessment were similar to his prior neuropsychological assessment on attending to learning; remembering; storing; retrieving; and manipulating new information (including short-and-long-term memory; all within normal limits). However, his scores on working memory recall and recognition; sustained and focused attention; impulsivity; appropriate response; hand/eye coordination; accuracy of selecting an appropriate response; sensory-motor/spatial functioning; word comprehension; verbal memory; planning; abstraction; and error correction differentiated the two assessments. He scored better on the WebNeuro assessment than the neuropsychological assessment on working memory recall and recognition (superior range); sustained and focused attention, impulsivity, appropriate response, hand/eye coordination, accuracy of selecting an appropriate response, word comprehension, verbal memory, planning, abstraction, error correction (all average range).

In addition to the general cognitive domains, WebNeuro also assesses emotional cognition relevant to the RDoC domains of negative and positive valence, whereas measures of emotional cognition are not included in traditional neuropsychological assessments. On a measure of emotion recognition, the patient performed well above expectations for age and education. Specifically, he demonstrated heightened sensitivity to salient emotional expressions, as indicated by fast reaction times combined with high accuracy when identifying angry, disgusted, sad, and happy facial expressions. Although this is inconsistent with the patient’s prior diagnosis of ASD, it could be that the patient taught himself how to identify emotions and facial expressions to compensate through excessive video gaming. There is also the possibility that he was more comfortable with computerized assessments than being interviewed in person.

On neuropsychological testing, MMPI-2 results indicated elevated Scale 8 (Schizophrenia), which may suggest psychiatric impairment beyond social anxiety or autism. Williams

and colleagues [11] demonstrated the utility of WebNeuro for assessing cognition in first episode schizophrenia and found cognitive impairment was most pronounced for: Verbal Memory, Working Memory Capacity, Vigilance/Sustained Attention, Verbal Processing and Negativity, and least apparent for Sensori-Motor. As such, our patient's performance on WebNeuro demonstrates a profile on testing that is inconsistent with schizophrenia. For example, our patient performed well on measures of verbal memory, vigilance/sustained attention, verbal processing, negativity, and sensory motor functioning. The MMPI profile should be interpreted with caution and may be reflecting other aspects of the patient's personality such as feelings of inadequacy and insecurity, or excessive fantasy and daydreaming, which had been reported to the therapist previously in the context of video games, television and movies.

The M.I.N.I. International Neuropsychiatric Interview (MINI), a widely used, structured, diagnostic interview instrument [12], indicated that the patient met criteria for a diagnosis of SAD, consistent with the therapist's diagnostic impression, but incongruent with the neuropsychological assessment.

### Medical work-up

In a subsequent evaluation by the patient's pediatrician, no medical problems were identified. The client and his family refused a psychiatric evaluation or consideration of pharmacological interventions.

### Imaging

No gross anatomical abnormalities were noted on imaging.

### Trans-diagnostic conceptualization and treatment plan

**Negative valence**—The negative valence system includes fear and anxiety reactions, chronic stress, and loss. The patient has several features consistent with a disruption to this system. Primary among these is his high anxiety and avoidance. Although the majority of his anxiety is in social situations, the initial intake assessment also revealed fear of getting in a car accident combined with avoidance of driving, as well as anxiety about tests and grades that led to avoidance of school. Furthermore, the WebNeuro assessment revealed a speeded reaction time to facial expressions of emotion, particularly pronounced for negative emotions, suggesting a bias towards negative or threatening information.

Performance measures and subjective report, and neural circuit information were consistent with a phenotype of anxious avoidance and apprehension. Heightened responsivity to the cues communicated by facial expressions may reflect a heightened sensitivity to emotional cues that occur automatically and may exacerbate one's normal bias toward sources of negative information. As a concrete example, if a person is "primed" to respond to negative emotion they might interpret otherwise neutral expressions as negative. As a result, in a person who is primed for negative communications, normal apprehensions about social situations may be heightened to the point of avoidance. While it remains speculative, this "anxious avoidance" type reflects alterations in the functioning and connectivity between



nodes of the salience network which include the insula, amygdala and anterior cingulate cortex [8].

Overall, disruption to the negative valence system was conceptualized as one of the patient's primary problems. Psychotherapy addressed this via guided relaxation skills, reducing avoidance through exposure to feared social situations and increased social engagement outside of therapy. Assessment throughout therapy indicated a steady reduction in anxiety over time.

**Positive valence**—The positive valence system includes approach behaviors, reward processing, goal-directed behavior, and repetitive or compulsive behaviors, which are conceptualized as maladaptive extensions of goal-directed behavior. The patient has some features consistent with disruptions in the positive valence system, including his compulsive internet use and other repetitive behaviors. However, this was not conceptualized as a primary concern or functional impairment.

**Cognition**—The cognitive system includes perception, attention, learning and memory, language, and cognitive control. The patient exhibited fluctuating deficits across many of these subdomains over time. He reported hyper-sensitivity to sensory input as well as attention deficits beginning in childhood. At intake, his scores on a cognitive screening measure indicated mild cognitive impairment, and his scores on a traditional neuropsychological assessment were consistent with deficits in executive functioning. However by four months later, and using a computerized assessment technique, the patient's scores on all cognitive domains were within normal limits. Although these normal scores are consistent with his high average IQ and his parents' impression of his intelligence, it is inconsistent with his difficulty in school. Overall, the patient's fluctuations in cognition were conceptualized as secondary to his anxiety symptoms. Consistent with this conceptualization is the combination of social anxiety and higher test scores in a computerized format rather than an in-person format. Thus, the patient's cognitive deficits were primarily addressed through targeting his anxiety as well as increasing focus and concentration ability.

**Social processes**—The social process system includes attachment, social communication, and understanding others' mental states. The patient exhibited deficits primarily in social communication, which were noted both in the initial intake and in the neuropsychological evaluation. However, he performed well on the research tests of emotion recognition through facial expressions, suggesting some ability to understand others' mental states. Overall, social skills deficits were conceptualized as a primary area of concern in interaction with the patient's social anxiety. Treatment therefore included social skills training, including role play of social scenarios, and progressive social assignments. The patient practiced identifying emotional states in others and was taught perspective-taking skills. The client was also encouraged to engage in behaviors that supported independence, initiative and assertiveness. These interventions resulted in significant improvements in this domain as assessed by the therapist.

**Arousal**—The arousal system is primarily focused on circadian rhythm and sleep disturbances. Although the patient reported some sleep disturbance, this was not a primary area of concern for this patient or a focus of treatment.

## Treatment outcome

The patient progressed in his social skills development through weekly social skills exercises that included resolving predetermined social conflicts of fictional characters. Additionally, the patient learned how to decrease social anxiety through deep breathing exercises and practiced focusing on the words and tones of other's speech to improve his interpersonal interactions. The patient made significant progress towards his treatment plan goals, including: decreased social anxiety, as demonstrated by efforts to engage classmates in conversation; improved social skills, as evidenced by ability to converse more openly and fluidly with therapist; and improved focus and concentration, as noted through patient's use of relaxation exercises. The patient also returned to school and was seeking outdoor sports and clubs to make new friends.

The patient was administered the Outcomes Questionnaire-45 at Intake (total score = 78; clinical cut-off = 63), one-year (total score = 35), and two-year (total score = 12) follow-up. His scores showed clinically significant reductions on all subscales (Symptom Distress, Interpersonal Relations and Social Role) such that his initial scores were clinically significant in all domains; at one-year and two-year follow-up, the scores were in the normal range. In addition, the patient was administered the Depression Anxiety Stress Scale (DASS) on a bi-weekly basis throughout treatment. At Intake, his scores were in the moderate range for Depression and Anxiety subscales and mild for Stress. By the second month of treatment, his scores on the subscales decreased to the mild range, and by the fourth month of treatment, his scores were all in the normal range on the DASS subscales.

## Limitations

The patient's improved scores on the WebNeuro assessment compared to the neuropsychological assessment could be partially accounted for by a treatment effect, such that his symptoms were already starting to remit at the time he was administered the computerized assessment. The administration of various tests and assessments at different time points should be recognized as a limitation of the current report. However, the therapist and clinical supervisor observed that the patient continued to make gains throughout treatment (over 2 years) beyond what was assessed on the symptom measures and especially benefited from the transdiagnostic approach that was integrated into his treatment plan.

## Conclusions

Conceptualizing this case through an RDoC lens aided in enhancing the patient's treatment plan by employing a more integrative treatment model. Specifically, a hybrid approach to treatment for SAD, ADHD and ASD was utilized because results from the research project indicated that this patient experienced an extremely rapid visual processing speed that prevented him from obtaining additional essential information about any given social



situation. For example, the patient tended to make quick judgments based on brief facial expressions of others that can lead to false conclusions that others were upset with him. Based on complementary assessment data, treatment included social skills training, progressive relaxation exercises, and basic psychoeducation in emotional expression and independent living skills. The patient practiced focusing on words and tones of language, rather than relying on his visual processes to improve his interpersonal interactions.

This case illustrates the utility of a transdiagnostic model, particularly when assessment results and other data points do not map neatly onto the boundaries of a traditional diagnostic model (e.g., DSM-5). Within the Research Domain Criteria framework, negative valence and social processes systems, for example, are key constructs that we may use in the future to explain phenotypes of psychopathology according to transdiagnostic dimensions of behavior and neural circuit function rather than according to the DSM [1,2,13]. Differentiating disorders using brain-symptom relationships is the next step for gaining a more precise understanding of the similarities and differences among psychiatric conditions. This approach offers rich information for the development of personalized treatment approaches.

### Ethics approval and consent to participate

The participant in this case study signed informed consent for his data to be used in a published case study report. The research study referenced above obtained human subjects approval from the Stanford University Institutional Review Board (FWA00000935; Protocol# 27937) and the Palo Alto University Institutional Review Board (FWA00010885; Protocol# 14-001-S).

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### Abbreviations:

<b>ASD</b>	Autism Spectrum Disorder
<b>ADHD</b>	Attention Deficit Hyperactivity Disorder
<b>RDoC</b>	Research Domain Criteria
<b>SAD</b>	Social Anxiety Disorder
<b>MINI</b>	M.I.N.I. International Neuropsychiatric Interview
<b>DSM-5</b>	diagnostic and statistical manual of the American psychiatric, association 5th edition

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**Table 1**

Assessment scores.

Context	Test administered	Result/percentile/classification
Intake assessment for therapy	Hopkins Adult Reading Test	FSIQ= 105.68 (Average)
	Montreal Cognitive Assessment	Total = 25/30 (Mild Cognitive Impairment)
	Depression Anxiety and Stress Scale	Depression = 17 (Moderate) Anxiety=11 (Moderate) Stress = 17 (Mild)
Outcome Questionnaire-45		Total Score = 78 (Above Normal Limits = symptoms of clinical distress)
		Symptom Distress = 45 (Above Normal Limits)
		Interpersonal Relations = 15 (Above Normal Limits)
		Social Role = 18 (Above Normal Limits)
Personality Assessment Screener		Below clinical significance; not interpretable
Therapist clinical assessment (formal treatment plan)	Psychosocial History and Behavioral Observation	<u>DSM-5: SAD</u>
		<u>DSM-5: ADHD</u>
		<u>DSM-5: Unspecified Neurodevelopmental Disorder</u>
		<u>DSM-5: Internet Gaming Disorder</u>
Neuropsychological testing	Wechsler Adult Intelligence Scale - Fourth Edition	FSIQ= 117; 87th% (High Average) GAI = 117; 87th% (High Average) - VCI = 114; 82nd% (High Average) - PRI = 115; 84th% (High Average) - WMI = 136; 99th% (Very Superior) - PSI = 86; 18th% (Low Average) AQ Diagnostic Impression: ASD
	Autism Quotient (AQ)	
	American College Testing (ACT) Composite Score	32 (98th percentile; Very Superior)
	WIAT-III (Expressive Language subtests)	- Expressive Vocabulary: 16/17 (Within Normal Limits) - Written Expression: Within Normal Limits

Context	Test administered	Result/percentile/classification
California Verbal Learning Test - Second Edition (CVLT-II)	<p>Trails 1–5, Correct (T = 55; Average)</p> <p>Total Learning Slope (z = 1.5; Superior)</p> <p>Short-Delay Free Recall (z = 0; Average)</p> <p>Short-Delay Cued Recall (z = 0; Average)</p> <p>Long-Delay Free Recall (z = 0; Average)</p> <p>Long-Delay Cued Recall (z = 0.5; Average)</p> <p>Recognition (z = 0.5; Average)</p> <p>Recognition vs. Long-Delay Free Recall (z = 1.5; Superior)</p>	
Rey Complex Figure Test (RCFT)	<p>Copy (11–16th percentile; Low Average)</p> <p>Immediate Memory (T = 57; 76th%; High Average)</p> <p>Delayed Memory (T = 48; 42nd%; Average)</p> <p>Recognition (T = 59; 82nd%; High Average)</p>	
Necker Cube	<p>Qualitative evaluation: Atypical approach, starting with side diamond; distortion and rotation are present in the copied cube</p>	
Delis Kaplan Executive Functioning System (DKEFS)	Trail Making Test	<ul style="list-style-type: none"> <li>- Visual Scanning (ss = 6; Low Average)</li> <li>- Number Sequencing (ss = 3; Moderately Impaired)</li> <li>- Letter Sequencing (ss = 2; Severely Impaired)</li> <li>- Number-Letter Sequencing (ss = 9; Average)</li> <li>- Switching vs. Visual Scanning (ss = 13; High Average)</li> <li>- Switching vs. Combined Sequencing (ss = 17; Very Superior)</li> </ul>
Verbal Fluency		<ul style="list-style-type: none"> <li>- Motor Speed (ss = 9; Average)</li> <li>- Letter Fluency (ss = 10; Average)</li> <li>- Category Fluency (ss = 10; Average)</li> <li>- Category Switching (ss = 9; Average)</li> <li>- Move Accuracy (ss = 10; Average)</li> <li>- Category Switching vs. Category Fluency (ss = 9; Average)</li> </ul>
Design Fluency		

**Context**

**Test administered**

**Result/percentile/classification**

- Solid Dots (ss = 8; Average)
- Empty Dots/Inhibition (ss = 8; Average)
- Switching (ss = 11; Average)
- Switching vs. Solid & Empty Dots (ss = 13; High Average)

**Color-Word Interference**

- Color Naming (ss = 1; Severely Impaired)
- Word Reading (ss = 6; Low Average)
- 1=2 Combined Primary Measure (ss = 4; Borderline)
- Inhibition (ss = 6; Low Average)
- Inhibition/Switching (ss = 4; Borderline)
- Inhibition vs. Color Naming (ss = 13; High Average)
- Inhibition/Switching vs. Inhibition (ss = 8; Average)
- Inhibition/Switching vs. Color Naming (ss = 15; Superior)
- Inhibition/Switching vs. Word Reading (ss = 8; Average)

**Sorting Test**

- Free Sorting (ss = 10; Average)
- Free Sorting Descriptions (ss = 9; Average)
- Sort Recognition Descriptions (ss = 10; Average)
- 1+2 Combined Description (ss = 9; Average)
- Sort Recognition vs. Free Sorting (ss = 11; Average)
- Time-Per Sort Ration (ss = 4; Borderline)

**20 Questions**

- Initial Abstraction Score (ss = 14; High Average)
- Total Questions Asked (ss = 11; Average)
- Total Weighted Achievement (ss = 10; Average)
- Spatial Questions (2nd percentile)

**Word Context**

- Total Consecutively Correct (ss = 10; Average)
- Consistently Correct Ratio (ss = 7; Low Average)
- Repeated Incorrect Responses (ss = 11; Average)

**Tower Test**

Context	Test administered	Result/percentile/classification
	Minnesota Multiphasic Personality Inventory - Second Edition	<ul style="list-style-type: none"> <li>- Total Subtest Score (ss = 5; Borderline)</li> <li>- Time to First Move (ss = 1; Severely Impaired)</li> <li>- Time Per Move Ratio (ss = 2; Severely Impaired)</li> <li>- Move Accuracy (ss = 13; High Average)</li> <li>- Rule Violations Per Item (ss = 10; Average)</li> </ul>
		Code Type: 8-0-2
		Schizophrenia (Elevated)
		Social Introversion (Elevated)
		Depression (Elevated)
		Alienation (Elevated)
		Lack of Empathy in Interpersonal Relationships (Elevated)
	DSM-5 Severity Measure for Depression, Adult (PHQ-9)	Total Raw Score: 7/27 (Mild Depression) Average Score: 0.78 (0-3 scale; 1 = Several Days Per Week)
	DSM-5 Severity Measure for Generalized Anxiety Disorder, Adult	Total Raw Score: 12/40 Average Score: 1.2 (0 to 4 scale; 1 = Occasionally)
	Personality Inventory for DSM-5	Negative Affect (Elevated) Detachment (Elevated) Disinhibition (Elevated)
Neurocognitive Behavioral Assessment	M.I.N.I. International Neuropsychiatric Interview 6.0	SAD
	Verbal Learning and Memory test	Memory Recognition <ul style="list-style-type: none"> <li>- Immediate recall (Average)</li> <li>- Delayed recall (Average)</li> <li>- Digit Span (Average)</li> <li>- Span Explicit Emotion Recognition (Average)</li> </ul>
	Continuous Performance test of Sustained Attention	<ul style="list-style-type: none"> <li>- Reaction time (Average)</li> <li>- False alarm errors (Average)</li> <li>- False miss errors (Average)</li> <li>- Switching of Attention (Average)</li> </ul>

Context	Test administered	Result/percentile/classification
	Motor tapping	<ul style="list-style-type: none"> <li>- Completion time (digits &amp; letters; Average)</li> <li>- Errors (digits &amp; letters; Average)</li> </ul>
	Motor Tapping	<ul style="list-style-type: none"> <li>- Number of taps (Average)</li> <li>- Variability of pause between taps (Average)</li> <li>- Choice Reaction Time (Average)</li> <li>- Reaction Time (Average)</li> </ul>
	Verbal Interference assessing constructs equivalent to the Stroop	<ul style="list-style-type: none"> <li>- Errors (Average)</li> <li>- Reaction time (Average)</li> <li>- Errors (Average)</li> <li>- Reaction time (Average)</li> </ul>
	Executive Function Maze test	<ul style="list-style-type: none"> <li>- Trials completed (<math>z = 2</math>; Borderline)</li> <li>- Completion time (Average)</li> <li>- Path learning time (Average)</li> <li>- Total errors (Average)</li> </ul>
	Go-NoGo test	<ul style="list-style-type: none"> <li>- Reaction time (Go; Average)</li> <li>- Variability of reaction time (Go; Average)</li> <li>- False alarm errors (NoGo; Average)</li> <li>- False miss errors (Go; Average)</li> </ul>
	Explicit Emotion Identification Test	<p>Emotion Identification</p> <ul style="list-style-type: none"> <li>- Fear% accuracy (<math>z = 2</math>; Borderline)</li> <li>- Fear reaction time (Average)</li> <li>- Anger% accuracy (Average)</li> <li>- Anger reaction time (<math>z = 4</math>; Severely Impaired)</li> <li>- Disgust% accuracy (Average)</li> <li>- Disgust reaction time (<math>z = 3</math>; Severely Impaired)</li> <li>- Sadness% accuracy (Average)</li> <li>- Sadness reaction time (<math>z = 3</math>; Severely Impaired)</li> </ul>



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Context	Test administered	Result/percentile/classification
		<ul style="list-style-type: none"><li>- Happiness% accuracy (Average)</li><li>- Happiness reaction time (<math>z = 2</math>; Borderline Impaired)</li><li>- Neutral% accuracy (Average)</li><li>- Neutral reaction time (Average)</li></ul>