EXHIBIT 2

Perelman School of Medicine
UNIVERSITY of PENNSYLVANIA

Neuropsychiatry Section

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CONFIDENTIAL
NEUROPSYCHOLOGICAL AND FACIAL ANTHROPOMETRIC EVALUATION

Name: ROOF, Dylann
Date of Birth: 04/03/1994 **Age:** 21 years
Education: 9 years (GED)
Status: Inmate
Lateral Dominance: Right hand, foot; Left eye
Dates of Evaluation: 02/01/2016; 02/02/2016; 02/20/2016

REFERRAL INFORMATION

Mr. Dylann Roof is a 21 year old, right handed Caucasian male referred for a neuropsychological and facial anthropometric assessment by defense counsel in Charleston, SC. He is suspected of perpetrating the 06/17/15 Charleston church shooting and is currently incarcerated at the Charleston County Detention Center, in the city of Charleston. At the outset of the examination, Mr. Roof was informed of the purpose and parameters of the exam and he acknowledged that his participation was voluntary and that he understood the importance of giving his best effort on the examination. The scope and limits of confidentiality were discussed and Mr. Roof was informed that the examiner would not be providing any treatment, clinical consultation, or conducting a feedback session about test results with him. Mr. Roof expressed his understanding of these facts and agreed to proceed with the exam.

MEDICAL AND HISTORICAL RECORDS REVIEWED

Bates #	Contents
D00001	SC Department of Education (GED Diploma)
D00062	Pediatric Records (Dr. Mubarak)
D00239	Richland One School Records
D00264	Lutheridge Health Forms (2006 & 2007)
D00281	Charleston Detention Center Records (2015.08.27)
D01048	Provost Academy Records
D01084	Perfect Attendance Hand MS 2005-06
D01085	White Knoll Elementary Yearbook 2000-01
D01152	White Knoll Elementary Yearbook 2001-02
D01609	Lexington I School Records
D01643	Medical Records - Palmetto Richland
D01720	Medical Records - Palmetto Baptist Non Medication Orders
D01724	Medical Records Palmetto Baptist 8.10.1996 Emergency Record - Hit on Mouth
D01733	Medical Records Palmetto Baptist 12.30.1996 - Chemical in Eyes
D01742	Birth Records Palmetto Baptist
D01956	Medical Records - Laurel Endocrine & Thyroid
D02039	School Records (Additional from Lexington)
D03420	Dental Records (Dr. Karen Park)
D03814	Medical Records - Eau Clair Cooperative

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D03858	Medical Records - Southeastern ENT
D03859	Charleston County Jail Records (received 2015.11.30)
D03971	Medical Records - SC Oncology
D04117	Dental Records - Dr. Sassnett
D04225	Charleston Detention Center Medical Records (rec'd 2015.12.16)
D04245	Incident Report - DR & Chandler Drunk and Disorderly 2010.12.03
D04243	DNA Parentage Test Report (DR)
D05748	Mental Health Records - Lexington Mental Health
D06186	School Records - Richland One Responsive to Subpoena
D07898	Medical Records - Carolina Occupational Health
D08569	Pharmacy Records - CVS
D08571	Pharmacy Records - Longs Drugs
D09128	Charleston Detention Center Medical Records (Rec'd 2016.04.26)
D09487	Medicaid Records
D10531	Pharmacy Records - CVS
	Text of DR statement on Last Rhodesian website 6-17-2015
	Roof Amy 2016 04 26 Interview Summary
US016752	Transcript, Dylann Roof, 2015.06.18 01/30/2016
US016840	Text Manifesto and Homepage, lastrhodesian.com 9/29/2016
US018512	Screenshot, GED Transcript, Dylann Roof 01/19/2016
US019985	GJ Transcript, Amber Roof, 2015.07.21 01/19/2016
US020018	GJ Transcript, Amy Roof, 2015.07.08 01/20/2016
US-VID-0001	Dylann Roof Confession

CLINICAL AND DIAGNOSTIC INTERVIEW

When asked about the time leading up to the crime, he stated that he had a “"pretty good life” prior to 2012 and that in general, he “stayed home and watched TV.” In 2013, Mr. Roof stated that he kept hearing about Trayvon Martin on the internet and after reading about the incident on Wikipedia he saw that George Zimmerman “was right” and that the case was “very clear” in that he was justified in shooting the man. Mr. Roof also reported that Mr. Zimmerman was being unfairly treated in the media. He stated that he then began searching “black-on-white crime” on the internet and stated he saw “pages and pages” of articles on this topic. He indicated that he was shocked that the regular media was not reporting on these issues. Mr. Roof stated that he found that a number of these stories on the internet “had a link” and that they were not “not invented,” or made-up. When question as to whether a person can believe everything they find on the internet, he continued by stating that he knows all of the conspiracy theories and which ones are true or not. He reported that the data he found revealed to him that “"thousands of white women are being raped each year by black men.” Mr. Roof also referred the examiner to statistics by the FBI which he reported showed many white deaths at the hands of black people. In addition, Mr. Roof reported that that he had seen “"dozens of videos of white people being beaten by black people.” When asked by the examiner if the reverse was also true, Mr. Roof stated that, “I defy you to find a video” where white people were beating up a black person. He stated that he was reading “terrible things” like this every day, and that no one – including him – were doing anything about it.

Mr. Roof gave other examples of what he came to learn in his internet searches stating that there is “Jewish control of everything” and that he could see it on television “"by their names and looks.” He

stated that Jewish people were extremely liberal, and that they "put anti-white material out there." He related that while he saw people advocating white power, they were "just talking," and that no one was doing anything about it. Mr. Roof indicated that what he "saw on the Internet woke [him] up" and that he thought ""what can I do that has some impact?" He stated at he had been thinking about what he might do for approximately seven months. He stated that he wanted to "help the white race" and that he "would go down in history" because of his actions. Overall, he stated that while he felt that his actions had not helped the white nationalist movement, he was "at peace." Mr. Roof related that while he feels better that he did something, he was still "angry about what is going on." He then went on to detail to the examiner numerous things he had found on the internet including findings on "Muslim rape gangs" and other anti-white statistics. When again asked how he could tell which stories were true or not, he stated that he could ""tell the difference." Mr. Roof stated that he was tired of police having to deal with uncooperative black people and that in general, "whites have suffered." Mr. Roof stated that he was never a political person, though he reported that he followed Ron Paul in 2012. Mr. Roof stated that he has tried to keep up with the recent presidential election, and that while he agreed with Donald Trump's policies, he was not ""far right enough."

When asked now that he is facing he death penalty or life in prison, if he had ever reconsidered his actions, Mr. Roof stated that it still was a ""good idea" as his "race was under attack." He stated that he did not care what people think about what he did. He stated that he cares about what will happen in the future when people look back and see him as a hero. Mr. Roof stated that the media has "wanted this for years" (i.e., a mass shooting of black people) and that he decided he would "give them what they want." That is, he would "give them a real racist attack."

Mr. Roof's responses to the Prime Screen-Revised, a screening instrument designed to identify psychotic symptoms, revealed elevations on two items. He endorsed 'some agreement' to the following items: #2 'I think that I might be able to predict the future'; #4 'I have had the experience of doing something differently because of my superstitions.' With regard to number 2, Mr. Roof related that he is "insightful" and that he can spot trends that others can't easily see. As a case in point, Mr. Roof was incredulous that the examiner (and others as well) could not see the racial issues and conspiracies that he can clearly see. He also stated that he knew what the outcome of these racial clashes would be; that that everyone would come around to his way of thinking about this topic. For item 4, Mr. Roof stated that he has always been superstitious and stated that he gives some credence to "jinxes" and curses. He reported that he will perform various actions when he feels it necessary to ward these off (i.e., knocking on wood).

As a child, Mr. Roof stated that he began to experience odd thoughts and feelings. He gave an example that around the age of 8 he began to notice that the "clouds were moving too fast" and that this meant "that something wrong or bad was going on." He also related that since he was quite young, that there was "something wrong with [his] forehead" and that he "looked weird." He stated that he sought to correct this by wearing his hair in a certain way that it covered his forehead. Mr. Roof stated that he has worn his hair this way ever since. It is notable that in the current exam, Mr. Roof refused to allow the examiner to take a 3D photometric-stereo image of his face as he "did not want any more pictures of [himself] floating around." He was quite adamant in his desire that no photographs of any type be taken, despite letting the examiner do extensive caliper measures of his face. He stated that he had to take "hundreds of photographs" of himself to get one or two pictures he was satisfied with for his website, the Last Rhodesian." When asked why he took so many pictures, he stated that he "just did

not look right" in most of them (referring mostly to his face), and that he would not let me or anyone else take photos if he could help it. Mr. Roof also stated that at the age of 10 or 11 years of age, he began having panic attacks and started to become fearful about leaving the house.

Mr. Roof stated that while he could not see the future, he felt that he would be either be "broken out" from prison after a white uprising in America or pardoned for what he did. When asked why he thought this would occur, he stated that once people became aware of what was going on around them, they too would come around to his way of thinking. As such, he reported that he was "80% sure" that there would be an uprising of white people and that he would be released and hailed as "a hero." He also stated that there would be the possibility that he could even be made governor of the state of SC due to his actions.

Mr. Roof reported a number of concerns about his body and body image. As noted earlier, he reported that he feels that his forehead is "weird" and that other parts of his body are quite asymmetric. For example, he stated that he felt that his left shoulder and ribcage is bigger or "more muscular" than the right side of his body. Mr. Roof stated that in general, he felt that the left side of his body was more developed and that this was due to the fact that the testosterone in his body was all on that side (i.e., he drew a midline down his body with his finger for the examiner). When told by the examiner that is not how circulating hormones work in the body, he persisted in his belief in that his testosterone was lateralized to one side of his body and that this is why the left side of his body is more developed. Mr. Roof also related that he feels he will be bald by the time he goes to trial given the rate of hair loss he is experiencing. When told by the examiner that it looked like he had a full head of hair with no observable thinning, Mr. Roof stated that "it is not falling out in clumps" but that he can tell his hair loss has accelerated. He noted that prior to getting arrested, he often slept 12-15 hours a night.

<u>Medical History</u>
Mr. Roof stated that he was born on 04/03/1994 at Baptist Hospital in Columbia, SC. He reported that he thought there were no problems with his birth and that his developmental milestones were attained on time. He reported that he had his "tongue clipped" around the age of two. He stated that he has a left-sided deviated septum.

He related that he has always looked young for his age and that someone just prior to his crime thought that he was 13 years old. Along this line, Mr. Roof expressed concerns about his relative lack of facial and body hair, stating that he was "just like [his] father" in this regard. He also related that his underarm arm hair is also "sparse." He stated that he has always been concerned about his appearance, stating that he wears his hair in bangs to cover his "high forehead." Mr. Roof also related concerns about hair loss, stating that his hair started falling out around August 15th while in jail and that he noticed this happening when he was showering.

Mr. Roof stated that he has always gotten nervous and anxious "very easily." He stated that he suffers from "pathological blushing" and has had this for as long back as he could recall. While he denied any changes in his sexual functioning, he experienced an episode of "pathological blushing" during interview with the examiner, and refused to speak about this topic further.

Mr. Roof denied any history of high blood pressure, cardiac problems, seizures, cancer, loss of consciousness, dizziness, migraines, broken bones or blood disorders. He denied any motor vehicle

accidents. Mr. Roof related an incident when he was around the age of 3 where his father accidently sprayed paint in his eyes that required a visit to the emergency room. He also related being seen at the hospital around the age of 16 or 17 due to getting intoxicated with a friend. He stated that he had consumed 8 shots of liquor and that the police were worried that he was too ill to return him home without having him evaluated. Mr. Roof stated that he had his first alcoholic drink at the age of 14. More recently, he stated that he would only drink when he could afford it. He estimated that he drank a pint of vodka per month. He stated that he started smoking marijuana around the age of 13, and only starting smoking regularly at the age of 14. Mr. Roof stated that he started smoking daily around the age of 17. He noted that he would feel "real nervous" when he smoked at this time. He also endorsed using benzodiazepines (i.e. Xanax, Klonopin, Valium) intermittently since about the age of 15 up to the time of his arrest. Mr. Roof also endorsed using opiates such as hydrocodone (~10 times) and oxycodone (~10 times). He stated he has also tried Ambien (~30 times), Adderall (~2-3 times) and cocaine (~5 times). He denied any heroin, psychedelic or IV drug use. Mr. Roof also endorsed daily Suboxone use for approximately one year. He stated that he was arrested at the mall at one point due to his Suboxone use. He also related he was arrested once prior for trespassing at the same mall.

Family Medical History
Mr. Roof stated [redacted]. He stated that his father works as a contractor and went to college, but did not graduate. His mother was reported to be 55 years old and was a homemaker. He noted that she did work at one time; cleaning other people's homes. Mr. Roof stated that she did not complete high school. He reported that he has one sister Amber, who is 26 or 27 years old. He also reported a half-sister [redacted] who is 16 years old. Mr. Roof stated that his biological father divorced from his mother at age 5 and he stayed with his mother. He subsequently lived with his mother and her boyfriend. Mr. Roof denied any family neurological or psychiatric history. [redacted].

Educational History
Mr. Roof was unable to provide the names of his schools, but stated that he attended elementary school from kindergarten to fifth grade and reported that he was never held back or received special intervention or remedial coursework. In middle school he stated that from grades 6-7 he was generally a B-student. In the 8th grade he reported the he began smoking marijuana and his grades fell to the C-D range. He also stated that he thought he had failed a few classes. In the 9th grade, Mr. Roof reported that he started failing classes, attaining grades in the D to F range. While he reported that he thought he had started the 10th grade, it was at this time that he started taking online classes at home as he was absent from school much of the time. He denied any clear disciplinary problems; though he thought at times that he talked too much in class. Mr. Roof stated that he typically was a pretty quiet kid and did not talk much to others. He reported having 5-6 friends in high school and that they were kids who "did pretty bad things." He reported that he took classes online for 3-4 years, and eventually received a GED approximately 1 to 1½ years ago.

Occupational History
After finishing his GED, Mr. Roof stated that he worked for a landscaping service for a "couple of months" and quit. After about a year, he stated that he returned to work at this job for a month or so. When not working, Mr. Roof stated that he spent a lot of his time on the Internet, and that he was getting considerable pressure from his mom and dad to get a job. Mr. Roof stated that his dream job would be to work at a convenience store at the airport. He stated that he would never get a job like that,

however, as he only had his GED.

BEHAVIORAL OBSERVATIONS

Mr. Roof was examined over the course of three separate days. He reported that he was 5’8½” in height and weighed 130 pounds. He was wearing a prison jumpsuit and appeared to be well-groomed. He was alert and oriented in all spheres. Gait was unremarkable, and no abnormalities of movements in the upper extremities were evident upon observation. Eye contact was fair to good. Observation of his running speech and interactions did not reveal any overt problems in expressive or receptive language functioning, though he frequently interrupted and would ask tangential questions or make irrelevant statements. In general, spontaneous speech was fluent, with no evidence of significant word-finding problems. He demonstrated no difficulty understanding verbal directions and his concentration was generally adequate. Affect was somewhat flat, though he intermittently would laugh inappropriately and interact in an immature manner. Notably, when asking about his relationship and sexual history, Mr. Roof suddenly stopped speaking, turned his head sideways and made a grimacing face. When asked by the examiner if he was o.k., he stated in a strained voice that “I can’t talk right now.” After this episode concluded (~ 1½ minutes) he reported that he has “pathological blushing” (i.e., erythrophobia) and that during this episode he felt very hot and uncomfortable. It was notable that no reddening or blushing was evident to the examiner during this time. He refused to speak further about the topics that he felt triggered this episode. Frustration tolerance was good. As noted below, Mr. Roof’s performance on standalone and embedded measures of cognitive symptom exaggeration was consistently intact, indicating that he was putting forth his best effort during the course of the neuropsychological exam. In light of this, the results of the current neuropsychological exam are felt to accurately reflect his present level of functioning.

NEUROPSYCHOLOGICAL PROCEDURES ADMINISTERED

Psychosocial: Clinical Interview; Review of Records. Performance Validity: Word Memory Test (WMT); Victoria Symptom Validity Test (VSVT); Dot Counting Test; Test of Memory Malingering; Reliable Digit Span; CVLT-FC; Embedded Measures. General Intellectual Function: Wechsler Test of Adult Reading (WTAR); Wechsler Adult Intelligence Scale-IV (WAIS-IV). Attention and Executive Function: Selected subtests from the WAIS-IV; Vigilance and Distractibility subtests from the Gordon Diagnostic Systems Continuous Performance Task (CPT); Mesulam Symbol Cancellation SCT); Tower of London – Drexel (TOL^{DX}); Booklet Category Test (BCT); Iowa Gambling Task (IGT); Cognitive Estimation Test; Trail Making Test; Oral Trail Making Test; Selected subtests from the Delis-Kaplan Executive Function System (D-KEFS); Wisconsin Card Sorting Test (WCST); Auditory Consonant Trigrams (ACT); Variability Toolbox. Memory and Learning Function: California Verbal Learning Test–Second Edition (CVLT-II); Logical Memory subtest from the Wechsler Memory Scale-IV (WMS-IV); Brief Visuospatial Memory Test-Revised (BVMT-R); Rey-Osterrieth Complex Figure (ROCF), Immediate and Delayed Recall; Warrington Recognition Memory Test (WRMT). Language and Related Functions: Behavioral observation; Sentence Repetition from the Multilingual Aphasia Examination (MAE); Comprehension of Complex Ideational Material from the Boston Diagnostic Aphasia Examination (BDAE); Boston Naming Test (BNT); Phonemic (FAS) and Semantic (Animal Naming) Word-List Generation; Kite Picture from The Western Aphasia Battery (WAB). Visuospatial/ Visuoperception/Visuoconstruction: Judgment of Line Orientation Test (JOLO); Benton Visual Form Discrimination Test (BVFDT); Benton Facial Recognition Test (BFRT); Hooper Visual Organization Test (HVOT); ROCF, Direct Copy. Sensory/Motor Function: Lateral Dominance Examination; Sensory-Perceptual Examination; Smell Identification Test (SIT); Tactual Performance Test (TPT);

Grooved Pegboard Test; Finger Tapping Test; Grip Strength. Emotional Function: Beck Depression Inventory-Second Edition (BDI-2); State-Trait Anxiety Inventory (STAI).

NEUROPSYCHOLOGICAL TEST RESULTS

Performance Validity: Mr. Roof's performance on standalone and embedded measures of performance validity was fully intact across testing sessions, indicating good effort throughout the neuropsychological assessment.

General Intellectual Function: A premorbid estimate of overall intellectual functioning fell in the average range (WTAR Full-Scale IQ = 106). Consistent with this estimate, results from the WAIS-IV revealed a Full Scale IQ of 107, which also fell in the average range. Relative to his superior verbal comprehension skills, he showed reductions in perceptual reasoning, working memory and processing speed. Scores for each WAIS-IV index and subtest are presented in the tables below.

WAIS-IV Indexes	Composite Score	Percentile
Verbal Comprehension Index (VCI)	127	96
Perceptual Reasoning Index (PRI)	107	68
Working Memory Index (WMI)	97	42
Processing Speed Index (PSI)	84	14
Full Scale IQ (FSIQ)	107	68

WAIS-IV Subtests

Verbal	SS	Percentile	*Perceptual Reasoning*	SS	Percentile
Similarities	14	91	Block Design	13	84
Vocabulary	17	99	Matrix Reasoning	11	63
Information	13	84	Visual Puzzles	10	50
Working Memory (WMI)			*Processing Speed (PSI)*		
Arithmetic	8	25	Symbol Search	6	9
Digit Span	11	63	Coding	8	25

Attention and Executive Functioning: Mr. Roof's performance on tests of attention, processing speed, and executive functioning was variable. Passive auditory attention as assessed by the WAIS-IV Digit Span subtest was in the average range (SS = 11) as were mental calculations (Arithmetic, SS = 8). His scores on a test of sustained visual attention (CPT Vigilance) were intact both for accuracy (z-score = 0.58) and reaction time (z-score = -0.41). Similarly, on a more difficult version of this same task with distracting information being present (CPT Distractibility), Mr. Roof's performance was also intact for accuracy (z-score = 0.82) and speed of response (z-score = 0.55). His scores on a visual cancellation test (SCT) was within normal limits (z = -0.60). Additional measures of basic visual attention (D-KEFS Color-Word Interference, Color Naming and Word Reading conditions), Mr. Roof's ability to quickly read words or identify colors was intact (Color Naming, T = 12; Word Reading, T = 12), as were inhibition skills (Inhibition, T = 14). In contrast to the latter performances, processing speed represented a relative weakness for Mr. Roof. As noted above, his Processing Speed Index was in the Low Average range (WAIS-IV PSI = 84, 14th percentile), and was significantly reduced relative to his much stronger verbal abilities. Along this same line, his Working Memory Index was also relatively weaker. Consistent with the latter finding, on a measure of auditory verbal memory and divided

attention/working memory (ACT), Mr. Roof's performance was toward the lower end of average for 9-second (z = -0.91), 18-second (z = -0.13) and 36-second (z = -0.53) intervals. Speeded visuomotor sequencing of numbers was low average (Trails A; T = 42) whereas presentation of this same task in an oral format was average (z = -0.18). His performance on a more difficult version of this task requiring cognitive flexibility (Trails B) was average (T = 56), while presentation in an oral format was toward the lower end of average (z = -0.96) and notable for a significant number of errors (z = -2.54).

On a measure of nonverbal reasoning, conceptual set-shifting, and problem-solving (WCST), his overall performance was strong regarding total errors (T = 77), perseverative responses (T > 80), perseverative errors (T > 80), nonperseverative errors (T = 67), and conceptual level responses (T = 76). Further examination of his performance revealed that he was able to attain all 6 categories (> 16th percentile) with no failures to maintain set. Similarly, his scores on the IGT (Net Total, T = 65), Booklet Category Test (T = 60), D-KEFS 20 Questions (scaled score = 10) and Cognitive Estimation Test (z = 1.25) were within normal limits. In contrast, Mr. Roof's scores on a measure of planning and execution (TOL^{DX}) revealed that his Total Execution Time and Problem-Solving Time were both in the impaired range (1st percentile for both). The latter findings seem to coincide with the processing deficits described earlier and against the back ground of borderline performance on the Total Move Score (5th percentile) and low average score on the Total Correct Score indicate that he struggled to accurately complete the task, which is a more likely cause of his slowed response times. Similarly, his performance on tests from the Variability Toolbox, revealed moderate impairments in response speed consistency in Simple Processing Speed (z-score = -2.15) and in Complex Reasoning (z-score = -2.51). A borderline increase in response variability was also observed in Visual Vigilance (z-score = -1.74). In contrast, no significant disruptions in response speed consistency was seen in Complex Processing Speed (z-score = -0.25) or in Visual Attention (z-score = -0.24). Choice Reaction Time consistency was above average (z-score = 1.81).

<u>Memory and Learning Function</u>: Mr. Roof's performance on a verbal list learning task (CVLT-II) was intact (T = 59), with a somewhat flat learning curve evident. Performance on an interference trial was lower average (z = -1.0). Mr. Roof's memory for the word list over both short- (z = 1.0) and long- (z = 1.0) delays was good. Borderline proactive interference was evident, however (z = -1.5). Mr. Roof also showed mildly elevated responding (z-score = 1.0), suggesting some concerns with monitoring of memory retrieval. Recognition testing was intact (z = 0.5). Forced-choice testing was perfect (16/16). Recall of prose passages (WMS-IV) was intact, both immediately (scaled score = 10) and after a half hour delay (scaled score = 10). Recognition memory was within normal limits.

In the nonverbal domain, Mr. Roof's overall performance on the BVMT-R was in the average range (T = 51), with a positive learning curve evident (T = 52. Delayed recall was also intact (T = 59) with good retention of material already encoded (100%, > 16th percentile). Recognition memory testing was perfect (> 16th percentile), with no false-positive errors evident. Consistent with the latter performance, immediate and delayed recall of the ROCF was in the average range (T's of 52 and 50, respectively).

In addition to these measures, Mr. Roof was administered a recognition memory test meant to lateralize temporal lobe dysfunction (WRMT). On this task, he identified 50/50 words correctly (Words, >75th percentile) and also identified 50/50 faces correctly (Faces, >95th percentile). The lack of discrepancy between the two subtests indicated no significant lateralization of deficits.

Language and Related Functions: Observation of his running speech and interactions did not reveal any overt problems in expressive or receptive language functioning. His ability to repeat sentences aloud (MAE Sentence Repetition) and to spontaneously name common objects (BNT) was intact (43rd and 75th percentiles, respectively). Auditory-verbal comprehension (BDAE, Comprehension of Complex Ideational Material) was also fully intact (T = 64). Phonemic word-list generation was above average (T = 61), whereas word-list generation to semantic cues was in the low average range (Animal Naming, T = 42). When asked to provide a writing sample describing a picture (WAB), Mr. Roof generated 4 sentences in a 2-minute time period. While the content of the writing sample was accurate in reference to the picture, the sentence structure and complexity was concrete (Flesch-Kincaid Reading Ease = 79.4) and relatively unsophisticated for his age and education (Flesch-Kincaid Grade level = 5.3). It is notable, that these scores are lower than his 9th grade level of schooling, and are lower than would be expected given his superior verbal reasoning skills.

Visuospatial/Visuoperception/Visuoconstruction: Mr. Roof's performance on two measures of very basic visuoperceptual function was fully intact (JOLO, z-score = -0.05; BVFDT, within normal limits). Similarly, his scores on tests of facial perception and discrimination (BFRT), complex visual-perceptual organization (HVOT, T = 50) and visuoperceptual planning and organization (ROCF, > 16th percentile) were generally intact.

Sensory-Perceptual/Motor Function: Examination of lateral dominance revealed Mr. Roof to be right hand/foot dominant and left eye dominant. Overall functioning ratings, however, showed him to be largely right-side dominant (raw = 17; right-biased). Visual fields were full to confrontation. Double simultaneous tactile, auditory and visual stimulation did not reveal any suppression (z-score range, 0.17 to 0.30). Fingertip number writing performance revealed three right-sided errors (z-score = -0.62) and one left-sided error (z-score = -0.006). Odor identification skills were toward the lower end of average (SIT = 35/40). Fine motor coordination was intact bilaterally (right hand, T = 60; left hand, T = 75). Similarly, bilateral fine motor speed was average for both right (T = 56) and left (T = 50) hands. Grip strength was in the borderline to mildly impaired range bilaterally (right hand, T = 31; left hand, T = 30). Moreover, his ability to remember (T = 40) and localize shapes (T = 40) by drawing them following tactile manipulation (TPT) was in the low average range overall, despite superior to very superior speed in completing the task with his dominant and non-dominant hands independently and together.

Emotional Functioning: Mr. Roof did not endorse significant depression symptoms (BDI-II = 4, Minimal Depression), though he did relate significantly elevated anxiety. Specifically, he endorsed high levels of anxiety on the day of testing (STAI-State = 90th percentile) and that such higher levels were typical for him in general (STAI-Trait = 88th percentile).

FACIAL MORPHOLOGY ASSESSMENT

Mr. Roof's height fell between the 25th and 50th percentile relative to his age and sex peers based on CDC normative tables. Weight fell between the 10th to 11th percentile for his age and sex. Caliper measurements of Mr. Roof's head and face revealed significantly reduced maximum cranial width (z = -4.54), minimum frontal width (z = -2.24), maximum facial width (z = -3.4) and cranial base width (z = -3.39) relative to healthy age, sex and ethnicity matched peers. Similarly, significant reductions in morphological facial height (z = -2.12), upper facial height (z = -2.04), and lower facial height (z = -1.63) were also noted. In addition, Mr. Roof's midline frontonasal facial features including the

subnasal width (z = -3.04), nasal protrusion (z = -1.77), and nasal height (z = -1.78) were also significantly disrupted relative to his matched peers. In the absence of any significant facial trauma or surgery, these disruptions in facial morphology and configuration are consistent with long-standing, neurodevelopmental abnormalities.

SUMMARY AND IMPRESSIONS

Mr. Dylann Roof is a 21 year old, right handed Caucasian male referred for comprehensive neuropsychological and facial anthropometric assessment by the defense counsel in Charleston, SC. He is currently incarcerated at the Charleston County Detention Center, in the city of Charleston.

Neuropsychological Function

Formal and embedded measures of performance validity tests revealed consistently good effort over the testing days, indicating that the current neuropsychological profile is representative of Mr. Roof's overall neuropsychological functioning. Results of intellectual assessment revealed abilities generally in the average range (FSIQ = 107, 68th percentile) which was consistent with a premorbid estimate in the same range (WTAR Full-Scale IQ = 106). Further analysis of the WAIS-IV revealed that superior verbal abilities were markedly stronger than average perceptual skills, an observation that is found in only 7.5% of individuals. Relative reductions in working memory and processing speed were also seen.

Against this background, results of neuropsychological assessment revealed mild but consistent reductions in processing speed, characterized by poor speed, planning, and error-monitoring. Most notably, he struggled with a task requiring complex problem solving and planning (TOL^{DX}), where his Total Execution Time was in the severely Impaired Range and his Total Problem-Solving Time was in the moderately impaired range. Significantly increased variability in response speed was also observed, and is consistent with what is seen in individuals at clinical risk for psychosis. His visuospatial, motor, and sensory skills were generally intact and unremarkable, with the exception of his grip strength, which was in the borderline range for both hands. He demonstrated some difficulty organizing tactile information into an internal representation on the TPT, scoring in the low average range for his memory of the shapes and their location in his reproduction. While basic verbal and nonverbal memory was intact, he did show borderline increase in proactive interference and mildly increased repetition. Semantic fluency was relatively reduced and his writing sample was concrete and below grade level expectations. Borderline to mild impairment in extremity strength was observed bilaterally. Mr. Roof did not endorse significant symptoms of depression at this point in time, but did endorse high levels of state and trait anxiety.

These scores and performances converge in indicating mild frontal system dysfunction characterized by reduced processing speed, variability in reaction time, poor speed, planning, and error-monitoring, increased proactive interference in memory, perseverative and rigid responding, and relative reductions in semantic fluency. Frontal system dysfunction has been associated with the types of symptoms experienced by Mr. Roof. The real-world implications of these impairments included disruptions of decision-making, coding and tracking new information, weighing options, adjusting to new information and modifying thinking and behavior. Overall, these types of deficits are core components of psychosis spectrum disorders.

Facial Morphology
The extant literature concerning the topography of craniofacial dysmorphology has indicated that these indices may reflect subtle disruption to a critical trajectory of embryonic-fetal craniofacial growth, particularly along the midline. As can be seen in his other medical history and the current data, Mr. Roof demonstrated the residua of an aberrant neurodevelopmental process including: 1) hypogonadism, 2) low testosterone, 3) disrupted sexual function, 4) autoimmune disease (Hashimoto's), 5) a relative lack of age-appropriate facial and body hair and 6) significant measured facial dysmorphology of the midline frontonasal structures. These deviations from typical facial morphology were significant, with most measurements falling at least two standard deviations below the mean relative to age, sex and ethnicity matched peers. Disruptions in frontonasal morphology have been consistently described in schizophrenia and related disorders, and the pattern of Mr. Roof's facial dysmorphology appears to be most aligned with this patient population.

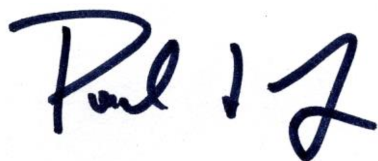
In summary, the neuropsychological, facial anthropometric and clinical findings converge in a pattern consistent with a long-standing neurodevelopmental disorder largely involving the frontal lobes. In early embryologic development, the face and forebrain develop in unison. This integrated development is thought to be responsible for facial dysmorphogenesis in disorders of early brain development as well as their associated cognitive and other deficits in adulthood. The latter data, when integrated with Mr. Roof's clinical history and presentation, suggest a neurodevelopmental disorder with psychosis spectrum features characterized by: 1) longstanding, persistent and unshakable somatic delusions, 2) magical, rigid and illogical thinking, 3) obsessive and rigid behaviors, 4) inappropriate affect (e.g., affective dysregulation, inappropriate laughter, grandiosity), 5) social withdrawal and isolation, and 6) evidence supporting some negative symptoms. Both Mr. Roof and his family described him as socially withdrawn, interpersonally awkward, passive, anxious, sad, isolated and odd/bizarre at times. Early on in his life, Mr. Roof described disrupted and magical thinking both about his body (i.e., his belief his forehead and general appearance are "weird"; concerns that one side of his body is more developed due to lateralization of testosterone) as well as the world around him (i.e., his description of the clouds moving too fast and that this event carried some ominous meaning; belief he will be freed due to white uprising and made governor of SC due to his recent actions).

It is notable that Mr. Roof stated that he never thought much about race previously and that the issues that led up to the shooting came to him "like an epiphany" when searching the internet about the Trayvon Martin case. He stated that everything "suddenly made sense to [him]." His thinking appeared to become even more illogical and disrupted, and a further decline in functioning, isolation from his family and other people, and disrupted/odd affect was noted. At the current time, his lack of acute psychotic and mood episodes precludes a more specific psychosis diagnoses. Mr. Roof's history of significant anxiety, deficits in processing speed, response variability, planning, and error-monitoring in the absence of visuospatial deficits, and past/current history of delusional beliefs about his body structure/function (body dysmorphia) and magical and grandiose thinking – while mild – are most consistent with a developmental disorder with psychosis spectrum features.

These conclusions are made within a reasonable degree of neuropsychological certainty. I reserve the right to amend these interpretations and conclusions should new information or studies become available.

Thank you for the opportunity to evaluate Mr. Roof. Please feel free to contact me at (215) 615-3608 if

there are any questions about my evaluation or report.



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