

Chapter 2

Neuropsychological Forensic Evaluations

The early neuropsychological role in forensic evaluations was primarily in the civil rather than the criminal areas. Individuals would be injured in car accidents or as a result of medical practice or through negligence which would result in cognitive, personality, motor, or sensory problems. Evaluations were the traditional comprehensive evaluations which made sense since any problem arising from the injury was potentially of interest to the court. Slowly, there was increasing involvement of neuropsychologists in criminal cases as well. Initially, much of this work focused on the identification of mental retardation as a mitigating or explanatory concept in the criminal behavior of the client. Over time, this has spread to a wide variety of cases, especially in regard to the roles of the frontal lobes in criminal behavior.

The frontal lobes (really the prefrontal and some anterior temporal areas of the brain) represent the far anterior parts of the brain roughly located over the orbit of the eyes. The frontal lobes are the most sophisticated as well as complex areas of the brain. Evolutionarily, this was the last area of the brain to develop and its development clearly differentiates humans from even the most sophisticated animals. As is the case in any relatively “recent” evolutionary development, the actual degree of development varies considerably, even more so than we see in the intellectual cognitive skills which are located primarily in the posterior (back) areas of the brain.

However, when dealing with court cases which involve the violent offender—most frequently in capital cases—the goal of the evaluation deals with establishing factors which act as motivators in deciding the appropriate punishment for such individuals. This is obviously a more important issue in those jurisdictions which allow the death penalty but can come into play in the disposition of murder cases in those jurisdictions where mitigation allows sentencing other than life imprisonment. In most cases the issue is not insanity, but rather an understanding of the cognitive processes and emotional processes, which explain how a given crime occurred and gives the judge and jury a better understanding of what happened beyond the evidence which can be generated simply by describing what happened.

Early evaluations for many individuals accused of serious violence focused on matters written into law: generally the presence of clear psychosis or the inability

to control or conform one's behavior due to mental illness along with the impact of substances and the possible presence of clear dementia. The earliest evaluations were primarily done by psychiatrists and neurologists, however, in the late 1970s, psychologists and neuropsychologists became part of the forensic team and increasingly became lead individuals in such teams, focusing on these diagnostic issues rather than necessarily focusing on an understanding of the crime.

Over time, due to the decision by several states and eventually the Supreme Court, there was an increased focus on the issue of mental retardation, as the courts came to refuse to execute such individuals. This resulted in attempts to classify all serious cognitive impairment as mental retardation even in cases where clients, while significantly impaired, did not meet the specific criteria for mental retardation. (This also, however, resulted in desperate attempts by prosecutors to prove that unquestionably mentally retarded individuals were not retarded based on technicalities and misuse of psychological testing.) This focus had the unfortunate side effect of often ignoring real cognitive disorders which impact the commission of capital crime or serious violence as much as, if not more than, mental retardation for forensic evaluations thus avoiding what is best practice for the neuropsychologist truly wanting to understand and explain why an act of violence occurred. However, as time has passed it has been clearly recognized that evaluations must go well beyond IQ levels, dementia, or psychosis, although the evaluation of such factors remains a component of any competent evaluation.

Before we look at the specific approaches best used in these evaluations, it is necessary to first examine what research has shown. While this research is generally limited in that it looks at groups of individuals rather than a unique individual client, it informs us of many of the issues which can arise in these cohorts. This presentation will focus on only a selected sample of the research to emphasize the important issues that are raised by this research.

Brain Injury

Although an accused murderer may in theory have injury in any area of the brain, much of the research has focused on the idea that violent offenders tend to display temporal and frontal lobe dysfunctions, which appear to be more pronounced in the dominant (usually left) hemisphere (Volavka et al. 1992). Research with batteries of neuropsychological tests on this population extends back only about three decades as it has become increasingly evident that factors other than insanity play a role in the behavior of the accused murderer.

One of the first studies to assess violent offenders utilizing a neuropsychological battery, the Luria-Nebraska Neuropsychological Battery, revealed that violent offenders were significantly more impaired on all of the summary scales of the test suggesting impairment in multiple cognitive skills but especially in more complex skills associated with the frontal and tertiary areas of the brain. In a mixed population with both violent and nonviolent offenders, 73 % of those who had

committed violent crimes showed evidence of brain injury, as compared to 28 % of the nonviolent offenders (Bryant et al. 1984).

The violent offenders showed evidence of more left (dominant) hemisphere injury than right hemisphere. They showed normal basic cognitive processes, but were impaired in processes which required them to integrate and analyze information beyond basic processes. They were bad at anticipating consequences of their thinking and showed poor insight into recognizing that they were making errors. They rarely showed traditional patterns of motor or sensory impairment in which there were clear signs of lateralized motor or sensory deficits, a staple of the traditional neurological and neuropsychological examination. Historically, the clients rarely had a clear single event which would account for their deficits, but often had history of dysfunction going back to childhood with a high rate of mild head injury throughout their lives. Rarely, however, had they been hospitalized for significant periods of time due to head injury or any other neurological disorder. They did, however, frequently show poor school performance and placement in special classes. Drug and alcohol abuse was common, but treatment for these disorders was uncommon. The sample tended to consist of individuals of low socioeconomic standards.

Williams et al. (2010) looked at the prevalence rate and risk for reoffending in prisoners with traumatic brain injury. One hundred and ninety-six offenders carrying sentences for a range of crimes such as violence, drug involvement, theft, or sexual offenses were assessed. A self-report questionnaire including demographic information, offending history, and TBI history, including LOC ratings, was given. Sixty-one percent of the respondents reported a head injury event with 16 % suffering moderate to severe head trauma, with 48 % reporting mild TBI, with 60 % of the mild TBI being recurrent. A history of TBI was significant for several factors such as age at entry into legal system, recent time in custody, and repeat offending. Those with a TBI history were younger (16.4 years) than those with no TBI history (20.1 years) when they first were convicted of a criminal offense. Those that reported a history of TBI indicated spending more time incarcerated in the last 5 years than those with no TBI history. The results indicated that they spent 7 more months incarcerated, and the results were significant when age was controlled for. Lastly, those that reported TBI indicated significant differences in reoffending compared to those with no TBI, as they were more frequently in custody.

Clearly, brain injury appears to play a significant role in reoffending. Such individuals—as a group—may be less able to adapt to the world around them, making them more likely to return to their former behaviors. They may be more rigid and inflexible. They may also be seen by others as socially unacceptable due to their behavior, befriended only by others who are similarly impaired or individuals who use their deficits to take advantage of them. In these cases, they become more likely to reengage in criminal activity which in turn places them into situations in which violence is more likely to occur. Many of these individuals are also poor at anticipating the consequences of their behavior, leading them into dangerous situations where violence is more likely. A number of clients with this

type of history who have been seen by the senior author report that although they placed themselves in dangerous situations, they were genuinely surprised when their gun or other weapon failed to stop rather than start violence. Indeed, they often saw themselves as the victim, forced to defend themselves from the aggression of others.

A case example seen by the senior author was an individual both likely born with brain injury and with a history of several moderate TBIs. He performed poorly in school and his friends were mostly low-level individuals including drug dealers and criminal gangs. While he was not a drug user, he would be paid to do tasks such as delivering packages or picking up material. Over time, it was suggested that he should start hijacking cars for his “friends.” They provided him with a gun (he had never owned one or shot one) and told him to go to the mall, go up to parked cars with women in them, show the gun, and take the car. This was done successfully several times and he was paid \$50 for each car he delivered to his companions. However, one day he went to a car, pointed the gun, and told the person to get out. Unfortunately for everyone, the person in the car was an undercover DEA Agent. The Agent lunged under his seat for his gun, shooting out from the car, followed by the client returning shots in “self-defense.” The Agent was hit and killed. The client afterwards was fully convinced that the episode was the fault of the agent and could not understand how he had caused the problem. He wanted his lawyer to plead self-defense at his trial. The client’s neuropsychological profile showed typical left hemisphere temporal-frontal profile along with a lower IQ and a lack of higher level executive functions.

Fazel et al. (2011) reported general population prevalence estimates of epilepsy to be around 0.5 % and traumatic brain injury to be approximately 0.3 %. Given that these neurological impairments have been linked with higher criminal behavior, the researchers set out to look into the link between epilepsy and traumatic brain injury and how they are related to violent behavior. By using the 1973–2009 Swedish population registers, they were able to examine associations of TBI, epilepsy, and subsequent violent behavior. The violent crimes included convictions for homicide, sexual offenses, robbery, arson, illegal threats, intimidation, or assault. Findings demonstrated that with regard to brain injury cases, 8.8 % committed the violent crime after their injury, which was a significant increase from the control group. There was a smaller but still significant difference when this comparison was done between the offender and their siblings with no brain injury diagnosis. For those with epilepsy, 4.2 % committed the crime after diagnosis, also a substantial increase from controls, although the magnitude of the difference declined after comparison with their siblings who were unaffected. Therefore, after accounting for family, epilepsy was not linked with violent crime risk, though traumatic brain injury was related to an increase in violent crime.

Other studies, however, have contended that temporal lobe epilepsy, rather than epilepsy per se, may be associated with emotional dyscontrol and aggressive behavior, although such behavior rarely rises to the level of murder where there is more planning such as the use of weapons or direction of the aggression towards a specific target that has psychological meaning (such as the guy down the street with the barking dog).

Such aggression is generally more random when it does occur and uses only weapons or devices in the individual's hands at the time of the seizure.

Van Elst et al. (2000) examined neuropsychological and neuroradiological results in clients with intermittent episodic dyscontrol (IED) to study the role of the amygdala in leading to aggression and dyscontrol. They examined 50 patients with temporal lobe epilepsy, half of whom had a history of IED and half of whom did not. The data examined included clinical, electrophysiological, and cognitive measures along with MRI results. They found no evidence of a higher rate of problems in the amygdala in the IED patients. Twenty percent of the patients with temporal lobe epilepsy and aggression had substantial atrophy in the amygdala which apparently was caused by a history of encephalitis. Twenty-eight percent of the aggressive patients had lesions in different parts of the left temporal lobe, so nearly half had temporal lobe lesions. They also found that IED was related to left-sided or bilateral EEG and MRI abnormalities, low IQ, and high scores in depression and anxiety.

One problem with studies like this is the difficulty in identifying what factor or factors are truly responsible for the aggressive behaviors. Are they due to the TLE or simply the underlying lesion in some cases, or they may be due to emotional or intellectual limitations which impair their ability to deal with stress. Even when there is a clear brain injury present, rarely does one not see these other factors as well, especially in the most violent and the most unnecessary crimes. It is likely that the brain injury is only one aspect of the reason why the individual develops aggressive behavior, with its importance varying from person to person. It is also clear that the presence of an actual seizure may not be the most important issue in most cases although there may be exceptions to this rule. What is of concern in most cases is the underlying brain injury that causes the seizure and its impact on cognition and emotion. (It should be recognized that not all seizures resulted in long-term cognitive or emotional problems as well).

The emphasis on the cognitive or emotional role of the seizure or underlying brain disorder can lead to unique formulations in individual cases. Golden (2007) described a case of an individual with clearly diagnosed psychomotor seizures associated with delusions that he was being chased by the devil. During a seizure episode, he attacked a relative believing that the individual had been possessed by the devil and was planning on attacking him. He began to hit the individual with his fists repeatedly, resulting in neighbors calling the police. When the police arrived, he begged them to help him to continue to subdue the devil. Due to their general poor health the relative died as a result of the assault. Of importance in this case was that prior to the attack, the relative and the patient had had a long positive and cooperative relationship unmarred by any animosity or violence.

Stoddard and Zimmerman (2011) utilized a longitudinal study, over 8 years, to assess for the impact of head injury on interpersonal violence. Participants were followed from mid-adolescence to the transition in adulthood and were recruited based on their GPA to study those at risk for high school dropout. Results showed a link between self-reported head injury and future reports of violence. Interestingly, the relationship between a head injury and violence was more significant

with a more recent head injury. While brain injury led to an increase in violence overall, it did not do so in every case. Thus, it is necessary to look at individual factors which may have influenced the outcome. Such factors may include: (1) a tendency towards violence or impulsiveness prior to the head injury which is exacerbated by the injury; (2) environmental levels of stressors; (3) the opportunity for violence in which a larger patient used to controlling others may be more likely to act out; (4) the degree and location of the brain injury; (5) the response of the environment to the client's behavior which may act to exacerbate or ameliorate the client's reactions; and (6) the expectations of the environment for the client which may place undue pressure for the client to perform as they did prior to the injury, leading to substantial frustration and the build up of anger.

In these cases, history becomes an important aspect of the evaluation but not in the traditional attempt to identify a single or unique cause to the disorder. Rather, there may have been many minor head traumas or a combination of early cognitive or developmental disorders later exacerbated by minor or major head injuries, exposure to substances, or medical problems which impact the function of the brain. In such cases, it is not possible to identify the specific cause that will satisfy a prosecutor. This, however, is not a failure of the testing or evaluation but rather reflects that many of these disorders are multidetermined. This is well removed from the early neuropsychological training of many practitioners which focused on trying to identify a specific cause of locus for all clients.

Bertsch et al. (2013) used region-of-interest-based and voxel-based morphometry approaches to explore structural differences between antisocial offenders with either borderline personality disorder or highly psychotic traits and controls. Other than distinct clusters of reduced gray matter volumes within the frontal pole and occipital cortex, little overlap in the regional distribution of brain abnormalities were found between the groups. Within the ASPD-BPD group, alterations were noted in orbitofrontal and ventromedial prefrontal cortex regions. Within the ASPD-PP group, volumetric reductions were significant in the midline cortical areas. It should be noted that there was a small sample size of 39 participants, with the authors recognizing that further research should be replicated on a larger sample. While the samples were limited in size, the study emphasizes that there is not one pattern of brain abnormalities which underlie either violence or personality disorders and in some cases there is none at all, focusing on the importance of treating each individual as a unique clinical constellation rather than looking for a single sign or pattern.

Ferguson et al. (2012) attempted to determine the prevalence rate of traumatic brain injury among South Carolina prisoners. The Ohio State University TBI Identification Method (modified for the study) was used to obtain TBI history. Overall, 275 max outs, 19 parolees, and 26 nonreleases were interviewed from the males and 267 max outs, 15 parolees, 33 long-term (plus 1 woman with more than 30 years) were interviewed for the females. 65 % of the male population and 72 % of the female population reported a TBI history. 50 % of males with life or death sentences reported LOC, while 42 % of male releases reported LOC. Conversely, 33 % of females with life or death sentences reported LOC, while 50 % of releases did.

Frierson and Finkenbine (2004) completed what they noted to be the largest study to date ($n = 270$) analyzing the psychiatric and neurological characteristics of accused murderers in the United States. They completed a retrospective record review of pretrial detainees who were undergoing evaluations for competency to stand trial and criminal responsibility. Competency demographic characteristics, psychiatric diagnosis, substance use patterns, Intelligence Quotient (IQ), and results of electroencephalogram (EEG), neuroimaging (MRI or CT), and neurological examination were examined. Results indicated that substance use and mood/adjustment disorders were common. Furthermore, neuroimaging was abnormal in 18 % of subjects and was associated with lower Performance IQ. However, they found that EEG and neurological exam findings were not associated with measured cognitive impairment. While 16 % of subjects had a FSIQ <70 , only 6 % were diagnosed with mental retardation. The retrospective record review also found that subjects who utilized a knife were more likely to have a psychotic disorder or anxiety. While results of this study were impressive, it is quite likely that the results actually underestimate the presence of relevant neuropsychological deficits in this population. There was an overreliance on IQ which is one of the weaker tests in the neuropsychological arsenal used to identify cases of fronto-temporal disorders although it can be useful in more serious injuries and in some early cognitive disorders (and obviously is essential when diagnosing mental retardation). Had tests like the Category Test or Wisconsin Card Sorting Test, for example, been used, it is almost certain that higher levels of neurocognitive disorders would have been identified.

In addition, while CT and MRI results were employed, both of these are static tests which simply visualize the structure of the brain, not its function. As an analogy, one may have a computer whose parts look on the surface to be perfectly normal and functional, but the computer will not turn on. Only when testing how the parts of the computer function both as individual parts and as part of a complex system can one identify if or why a given computer is not working properly. Thus, while the CT and MRI represented great advances over previous evaluations they are not the final word: when problems are found, they can be relied upon as indicating the presence of a disorder, when they are read as normal it simply means that it failed to find anything—it does not mean nothing is there.

Tests which measure the actual function of the individual parts of the brain are closer to identifying the level of neurological or neuropsychological dysfunction. EEGs were intended for such purpose, but they fail to look at the brain at a fine enough level to be either consistent or useful. Of greater use are tests like Positron Emission Tomography (PET) or functional MRIs (fMRI), tests which measure actual brain functional levels rather than just the static structures. These tests are limited because of the complexity of separating out normal variation from actual dysfunction across human brains. This requires a more statistical approach to understanding the significance of variations compared to normal controls as well as variations within the brain of the individual as well. Even these tests are limited, however: our ability to examine the functioning brain *in vivo* is clearly better, but there are many more sophisticated devices to come. In the future, they will identify

many more abnormal variations associated with more variations in cognition and personality than can be done today. As a consequence, these devices are most helpful when a clear variation is identified and can be linked neurologically and neuropsychologically to variations in emotional control and cognitive processes rather than used by themselves without external support.

Nevin (2000) compared changes in blood lead levels in the United States with subsequent changes in IQ, based on norm comparisons for the Cognitive Abilities Test (CogAT) given to representative national samples of children in 1984 and 1992. It was found that the CogAT norm comparisons indicated changes in IQ levels that were consistent with an earlier study's results and population changes in average blood lead for children (under age 6 between 1976 and 1991) suggesting a blood lead to IQ relationship. Furthermore, there was an association between gasoline lead exposure and long-term trends in changes in violent crime and unwed pregnancy. Subsequent trends in murder rates going back to 1900 were also strongly associated with paint and gasoline lead exposure. Overall, it was determined that the associations found related to unwed pregnancy and violent crime were consistent with previous research of IQ and social behavior. Authors noted that "the findings with respect to violent crime are also consistent with studies indicating that children with higher bone lead tend to display more aggressive and delinquent behavior. This analysis demonstrates that widespread exposure to lead is likely to have profound implications for a wide array of socially undesirable outcomes" (p. 1).

This study illustrated one of the multiple possible causes of neuropsychological dysfunction in violent inmates. The findings were again impressive because of the limit of the evaluations to an IQ test rather than a more comprehensive neuropsychological battery. Lead affects not only IQ but has an even larger impact of frontotemporal executive and emotional control abilities, as do most forms of heavy metal poisoning and many metabolic disorders which impact the brain. As noted above, the anterior areas of the brain are the last areas of the brain to develop, making them more vulnerable to insult from lead and other poisonings in childhood and adolescence as well as other insults such as TBI. In addition, these areas are the most complex neurologically with more neurons and more connections than other parts of the brain. As a consequence, they are more easily disrupted as complex systems generally are more sensitive to interruption than are simple systems (the dysfunction rate between an abacus and a computer, for example). These areas are also more metabolically active when properly functioning than other areas, making their need for nutrients and oxygen more acute—thus when there is an interruption due to any cause these areas suffer to a greater degree and may recover more poorly.

Bergvall et al. (2001) utilized the Cambridge Neuropsychological Test Automated Battery to evaluate prefrontal cognitive processing in violent offenders undergoing a forensic psychiatric assessment. Researchers preselected five tasks that were meant to measure executive functioning and included spatial and figurative working memory, planning, and attentional set-shifting. The violent offenders were included as long as their Full Scale IQ was at least 85 and they did

not exhibit symptoms of a psychiatric disorder such as hallucinations that would invalidate or skew test results. The average IQ of offenders included in the study was 99.0 ± 2.5 . The felonies included manslaughter/grave assault, arson, and sex-related crimes, with half of the group on trial for the first time.

Performance was then compared to a nonviolent control group with average intelligence and a group with mild mental retardation. On a task of maintenance of attention, the research group made more errors than the mentally retarded participants. These error types were also correlated with working memory and results suggested that poor performance on the attentional task was negatively correlated with performance on spatial and figurative working memory.

The research results indicated that violent offenders exhibit impairments in inhibitory control. They have difficulty adjusting their behavior in response changes in the emotional significance of stimuli and they also show difficulty shifting attention between categories. "The violent offenders committed on average three times as many errors as the controls when laboring to discover the rule underlying the new problem. Even individuals with mental retardation- of sufficient magnitude to thwart normal education and occupation- made significantly fewer errors when learning this novel discrimination" (Bergvall 2001, p. 1102). This pattern of errors continued into the next stage, where the subject had to learn that the previously incorrect exemplar was now relevant. Most control and mentally retarded individuals were able to quickly work out the new rule, whereas several offenders failed to learn this new rule at all.

This again was a study which limited its own findings in terms of the severity of the injury in the violent client. They did this by both requiring a normal IQ which eliminates many of those who are the most impaired as well as including some crimes which may be more planned or organized. This is an important issue in the assessment of the violent criminal: in general, the more thought-out and well-organized a violent crime by the individual, the more likely the criminal will show neuropsychological deficits. The violent criminal with frontotemporal deficits generally shows inhibitory problems as noted in this and other studies and, therefore, do not plan well, as this study and others have shown. It is also not unusual that such individuals also have lower IQs, although they may not meet the criteria for mental retardation.

This notion varies considerably whether one speaks to a defense lawyer or a prosecutor. (In one case, the senior author was told that the fact that the client was capable of moving a finger to pull a trigger was a clear indication of planning and organization.) All behavior represents some level of planning and organization; the question is what is the level of sophistication and complexity of that planning and organization.

When an individual holds up a Seven-Eleven and shoots the clerk to eliminate a witness in a preplanned manner, that shows a higher level organization and planning than does someone who robs the same store, but shoots only when confronted with a gun by the clerk. If someone plans to "take out" the witness and either avoids or successfully avoids or eliminates visual surveillance, that is a higher level than either of these cases. However, if the planning is done by

someone else, such as a gang leader or other guide, then the individual involved is actually showing no planning or organization, just the ability to follow instructions. It is not unusual that the person who is prosecuted is not the planner, but rather is the follower who gets caught primarily because of their inability to reason well.

One way to analyze whether there has been a more sophisticated level of planning is to compare the behavior to that of what an average 10-year-old could accomplish in terms of planning and organization. It is important to recognize that planning and organization do not suddenly appear in adulthood but go through developmental changes through childhood and adolescence into early adulthood (and then may even decline through normal aging). Thus, the presence of these skills does not necessarily indicate the absence of dysfunction. Adults with normal frontotemporal skills should show a higher level of these skills than the hypothetical 10-year-old. Such 10-year-olds are not prosecuted as adults because the law recognizes that they are incapable of executing these skills and recognizing the long-term consequences. They live more in the moment and reach with fewer internal inhibitions and controls. This is similar to the behavior of adults with impairment in these skills even when—as shown in this study—they have normal intelligence.

The issue of understanding consequences is also crucial to this analysis. Taking a gun to a robbery or confrontation may indicate planning to kill, but it may also indicate a desire to be protected or a desire to be in control. The individual may or may not recognize that simply taking the gun increases the chance for violence. An individual may steal a purse and run away without ever considering that the 70-year-old woman will not let go of the purse and be dragged to her death. One 80-year-old man shoves a man who “butted” into a movie ticket line and never anticipated the man falling, hitting his head, and dying. The actual level of anticipation or the ability to anticipate will tie in closely with frontal-temporal focusing.

Other studies have attempted to look at the relationship between aggression and impulsivity. A 2003 study by Sanford et al. suggested that aggressive behavior be classified as either predominately impulsive or predominately premeditated, with their results indicating that most individuals fall into a “mixed” group, emphasizing the complex nature of these issues and the need to look at the developmental level of the actual behavior. Lindberg et al. (2004) found that habitually violent men with Antisocial Personality Disorder were found to have higher rates of an abnormal sleep structure and childhood ADHD, believing that the two disorders seem to partly share a deficit in the central nervous system linked through the attentional/impulsivity systems within the brain.

Understanding the role of attention, violence, and aggression is neither easy nor simple. This arises in part from the fact that the behaviors are not inextricably linked as aggression, but are multidetermined by many factors. One individual may be impulsive, but may only say inappropriate things. Another may act out physically but ineffectively; however, give that individual a gun and we may have a case of violent aggression. Gender and cultural roles may also play a major

factor. The more an individual's culture or subculture allows physical violence with a weapon as opposed to fighting or verbal aggression may make a major difference in how neuropsychological deficits are expressed. Any theory which sees a one-to-one relationship between any of these factors and violent behavior is inherently limited and does not reflect the complexity seen in real life.

For example, one study investigated the role of impulsivity among incarcerated women with antisocial and violent behavior (Komarovskana et al. 2007). Five hundred and ninety female inmates in a maximum security prison were assessed utilizing various measures such as the Barratt Impulsivity Scale, Structured Clinical Interview for Personality Disorders Screening Questionnaire, Prison Violence Inventory, and number of institutional infractions. Female violent offenders, in contrast to their male counter parts, did not display higher levels of impulsivity than nonviolent offenders. This may reflect a gender difference in attitudes towards aggression.

Enticott et al. (2007) compared 10 violent male offenders (inpatients in a forensic psychiatric hospital) with a mean Full Scale IQ of 103.43–10 “healthy” controls matched for age and IQ. Participants completed the Inhibitory Reach Task (IRT) and the Stop Task, which measure the attempted suppression of a forbidden response and the Dynamic Appraisal of Situational Aggression-Inpatient Version (DASA-IV). The author's hypothesis was not confirmed, as group poor behavioral inhibition was not linked with inpatient aggression. This may reflect the difficulty in measuring inhibitory skills across modalities. The authors noted that this was contrary to prior research and contributed to the belief that aggression is complex, is a broad concept to define, and the offenders behavior in an inpatient setting may differ widely from their behavior within the community, especially given that staff is likely to avert aggressive situations within the setting. This may also reflect that the sample was small and that the tests employed were rather basic and may not have adequately reflected differences among the subjects.

This may reflect that when we discuss attentional concepts and impulsivity we are not discussing one-dimensional constructs. For example, one may show impulsivity in motor measures but not show such impulsivity in verbal or spatial tests. The attentional system is also tied in closely to the emotional systems of the brain. Attentional or impulsive problems may arise only when there is emotional activation as well. Thus, only tests which are complex enough to cause frustration or similar negative emotions would be likely to demonstrate the presence of such a dysfunction. In such cases, the individual may appear to be completely normal in the absence of emotional arousal secondary to internal or external stressors. Such stressors may also arise from physical sources such as fatigue or the reaction to illness or ingested substances. Overgeneralization from testing to real situations, from one form of testing to another, or from one specific situation or circumstance to another misses the complexity of real individuals involved in violence. The pattern with each individual combining testing, behavior, and history which takes into account neuropsychological, intellectual, emotional, social, environmental, and medical issues needs to be identified to understand any given individual.

While all these factors may not be relevant in a given case, they must always be considered.

Levi et al. (2010) utilized the IVA continuous performance task to look for differences between predatory, irritable, and nonviolent offenders. Significant differences were found on the Auditory, Visual, and Full Scale Response Control quotients. The irritable aggressors scored in the lower limit of the low average range on all three Response Control Scales signifying a higher level of impulsivity and inability to inhibit responses according to the demands of the task and commission errors were made on both auditory and visual stimuli. However, the predatory offenders did not display the tendency to respond impulsively, with their scores similar to the nonviolent group. With regard to Attention, significant differences were found on the Auditory, Visual, and Full Scale quotients. The non-violent offenders scored in the Average range on all three attention scales, the irritable aggressors scored in the lower limit of the average range, and the predatory aggressors exhibited impaired function compared to the nonviolent offenders group, scoring in the upper limit of the low average range. Separating the groups into predatory versus irritable (or impulsive) individuals was important in recognizing that we are dealing with different mechanisms depending on the nature of the crime.

Cohen et al. (2003) conducted a study investigating the role of impulsivity and verbal deficits with domestic violence. Forty-one batterers, enlisted in a domestic violence program were compared to 20 matched, nonviolent men. On the Adaptive Rate Continuous Performance Test (ARCPT), a measure of prolonged attention, the groups did not differ on measures of attention, however, significant differences were found on measures of impulsivity. The batterers showed more response breaks on Porteus Mazes, higher false-positive errors on the ARCPT, and shorter latencies on the Time Estimation task. This is significant as batterers, although likely to repeat, are often very irritable and impulsive in their criminal activity. They frequently show remorse after each episode which induced the victim to drop charges and to stay around. Even when their remorse is sincere, those who are irritable/impulsive repeat, especially when emotionally aroused.

The link between emotional arousal and dyscontrol leading to inappropriate or violent behavior is especially interesting from a neurological perspective. When examining models of brain function, such as Luria (1966), it is clear that emotions and fundamental functions of attention arise from the more primitive parts of the brain, while emotional control and inhibition at an adult level are the function of the highest levels of the brain. As the brain developed through evolution, higher levels of the brain assumed increased control over the more primitive levels of the brain, a pattern which can be seen in animals as the brain developed and enacted in every child as he or she develops from an infant into a fully developed adult (barring an injury during childhood). The frontal lobes in the adult use the descending reticular activating system to control the lower emotional centers, allowing most of us as adults to control violent and other inappropriate emotional responses, which, in turn, allows us to live in highly social and crowded conditions better than other animals.

However, there is also an ascending reticular activating system which extends from the most basic areas of the brain into all areas of the cortex. This system allows for differential arousal of different areas of the brain when necessary to respond to internal and external demands, as well as the ability to decrease arousal to relax and initiate sleep. While this system is essential to normal behavior, it can fail in multiple ways. In some cases, emotional and arousal issues in the primitive areas of the brain cause overarousal of the frontotemporal lobes which is perceived as anxiety or danger. When these factors are extreme, individuals may suffer from the most extreme psychological disorders. In milder cases, the individual can function well except under stress where the overarousal interferes with the functioning of the higher levels of the brain, resulting in what is essentially a regression to the behavior of a child or adolescent rather than an adult. These patterns of frontal-temporal dysfunction arise without any actual damage to those areas. When there is damage to the frontal-temporal areas, the impact of this phenomenon is exaggerated and magnified. In either case, problems in basic attention, arousal, or impulsivity may be evident at an early age.

In other cases, the damage is not to the more fundamental areas of the brain, but only higher cortical levels. In such cases, early development may be normal as the frontal-temporal levels do not develop the ability to significantly control lower levels until adolescence. When the ability to control is developed by a damaged frontal-temporal area, then there may be a decrease in emotional control as the dysfunctional area takes control of the brain. In such cases, there will often be later onsets of dysfunctional behavior. These individuals will frequently never show any deficits in the basic attentional skills.

In line with these theories, Retz and Rosler (2010) suggested that ADHD—which would reflect dysfunction of the more primitive areas of the brain—is associated with social problems and aggressive behavior. As hyperactive-impulsive traits are core symptoms of ADHD, it has been hypothesized that reactive-impulsive violence is more likely related to ADHD psychopathology than proactive-instrumental violence. One hundred and twenty-seven adult violent offenders participated in the study using ratings of reactive and proactive features of the committed crimes and ADHD diagnosis. According to DSM-IV, 16.5 % subjects fulfilled diagnostic criteria for ADHD, 23.6 % were diagnosed as ADHD in partial remission, and 59.8 % had no ADHD. Results revealed that both ADHD groups had higher reactive violence ratings when compared to those with no ADHD diagnosis. The opposite was found regarding proactive violence ratings. When age, gender, and comorbid substance use disorders were controlled for, childhood ADHD psychopathology and current ADHD significantly increased the risk of reactive violence and decreased the risk of proactive violence, with a significant difference of proactive violence found in males. The findings suggest that ADHD is associated with reactive but not proactive violence in aggressive offenders, consistent with the theories presented earlier.

Kaplan and Cornell (2004) looked into the presence of psychopathy and ADHD in adolescent male offenders and investigated if psychopathy and ADHD could predict violent behavior. One hundred and twenty-two detained males, between the

ages of 13–18 years were evaluated. Offenses included 64 % with a violent offense and 15 % with a history of sex offending. Results demonstrated a weak relationship between ADHD and psychopathy as ADHD indices were not associated with Factor 1 or total scores, but were associated with Factor 2 scores of the Psychopathy Checklist: Youth Version for those with an ADHD diagnosis and history of psychostimulant medication. However, no relationship was found between an ADHD diagnosis and psychopathy. This is consistent with the above as psychopathy is not known to be associated with the attentional/emotional mechanisms previously discussed.

Lopez-Leon and Rosner (2010) compared the IQ of juveniles, between the ages of 14 and 16, that had been convicted of committing a violent crime in New York with adolescents in the general U.S. population. They found that there was a statistically significant difference between the two groups on the Wechsler Intelligence Scale for Children-4th edition (WISC-IV). This held true for not only the Full Scale IQ (FSIQ) but also for the Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), and Processing Speed Index (PSI). Eighteen were found to have a Full Scale IQ more than one standard deviation below, and nine of them fell in the mental retardation range. No statistical differences were found on the Working Memory Index (WMI). It was found that 11 of the 27 individuals had a documented history of head injury, with three having lost consciousness. Additionally, it is important to note that while they were compared with adolescents from the general population, utilizing the WISC-IV norms, the sample of violent adolescents included 20 with a reported substance abuse history, 5 diagnosed with Depressive Disorder NOS, 5 with Disruptive Behavior Disorder, 3 with Conduct Disorder, 2 with Attention Deficit/Hyperactivity Disorder, two with Learning Disabilities, one with Generalized Anxiety Disorder, and 1 with Bipolar Disorder.

An earlier study conducted by Busch et al. (1990) conducted with adolescents convicted of murder found differences in homicidal adolescents including lower perceptual and Full Scale IQ scores, and increased educational difficulties. Diamond et al. (2012) found that an inmate's IQ, along with the average IQ of the prison unit, was negatively related to violent prison misconduct, even after controlling for age, race/ethnicity, and education. The authors suggest that prisoners entering the system with lower IQs are not as adept at navigating the social circumstances, and as a result are more susceptible to violent situations.

These studies suggest that adolescents convicted of serious aggression clearly have dysfunction associated with multiple areas of the brain at an early age. They develop not only aggression but many other maladaptive patterns. However, it remains important to recognize that not all have brain injury. In many cases, we are dealing with individuals whose problems can be traced at least in part to severe environmental issues. We must however recognize that many individuals from the same environment do not develop psychiatric or criminal behavior. It appears likely that the presence of neuropsychological factors aids in predisposing these

individuals to being unable to handle the demands of the environment. In such cases, we would expect the dysfunction to be in the more primitive areas of the brain which have the greatest influence on childhood development.

Ultimately, in all individuals, there is likely a balancing issue between neuro-cognitive and emotional resources and stability and the stressors as experienced by the individual. The greater the available resources, the more stressors which can be tolerated, although this likely has a temporal component: stressors which are bunched together are more likely to overwhelm resources than those which are spread out. Stressors over time may also reduce total available resources. In these analyses, the stressors are not only pressures from the environment, but pressures from medical conditions, substances, and those which are generated internally through attitude and misidentification.

DeLisi et al. (2009) wanted to test the stereotype that psychopaths have a higher than average Verbal IQ. They stated that this stereotype has come from movies such as *Silence of the Lambs*, where the psychopathic character is portrayed as someone who is so intelligent they can continuously outsmart law enforcement. The researchers assessed inpatients from psychiatric units in three cities, with an array of diagnoses such as schizophrenia, schizophreniform, schizoaffective disorder, major depression, dysthymia, bipolar disorder, brief reactive psychosis, delusional disorder, alcohol or other drug abuse or dependence, or a personality disorder. Of 1,136 original participants, 840 were available at follow-up, when the assessments were administered. Psychopathy was assessed with the Psychopathy Checklist Screening Version (PCL:SV). Verbal IQ was assessed with the vocabulary subtest of the WAIS-R. Results suggested that verbal IQ was negatively correlated with the total score on the PCL:SV; those with the higher psychopathy scores obtained lower verbal IQ scores. However, this study suffered by identifying those with psychopathy from a psychiatric sample, a group often significantly different from those seen in a criminal setting and those not in either setting. The latter group tends to have the higher IQ than the group studied.

However, the study brings up the issue of whether psychopathy is related to neurocognitive dysfunction. There is no clear evidence linking neurocognitive injuries to being diagnosed as a psychopath. Although some brain injured patients are known to have troubles with empathy (as well as recognition of their own emotions), they do not develop the other symptoms which would classify them as psychopaths. In the experience of the current authors, those charged with impulsive violent acts—those most likely related to neurocognitive issues—are rarely correctly diagnosed as psychopaths, although they may be accused of this because of criminal histories. It should also be noted that higher psychopathy scores on the PCL-R and SV-in psychiatric patients are generally not high enough to diagnose the individual as a psychopath.

Hanlan et al. (2012) found that the verbal memory ability, as measured by two measures from the California Verbal Learning Test (CVLT), of homicidal schizophrenic individuals were significantly worse than nonviolent/noncriminal schizophrenic individuals. Specifically, significant differences were found regarding the total number of words recalled across the five trials and the total

number of words recalled on Trial 5. No significant differences were found on the Logical Memory subtest of the Wechsler Memory Scale-3rd edition (WMS-III) for either the immediate or delayed recall. However, authors noted that a medium effect size was evident in regards to the delayed recall, with murders performing worse.

The issue of memory deficits in homicidal defendants is complicated in this study by the presence of schizophrenia, although the control group was schizophrenic as well. In such studies, it is also important to see if there are impairments compared to the normal population in both groups. It has generally been unclear what the role of memory deficits are in individuals who are accused of murder. In general, the presence of memory deficits alone in the absence of executive and attentional/emotional problems do not seem to add any additional information to the understanding of such defendants, as is also the case with measures of motor and sensory skills. While memory problems are generally included in neuropsychological examinations, deficits may only indicate the extent of an injury or may confirm attentional rather than memory deficits. While low scores may be used in an attempt to try to prove that an individual cannot cooperate in their own defense because they cannot remember what happened, the tests generally used to assess memory do not address this issue.

The Frontal Lobes

As previously noted, the focus on research into severe aggression has focused on the role of the prefrontal cortex. Many studies have used a variety of frontal lobe tests with aggressive populations in order to support this conclusion. One problem with such studies is the nature of frontal lobe tests. The best tests are those which demand the client figure something out which requires flexibility, insight, or complex problem solving. The problem exists in many in that they can be solved by chance simply by trying all possibilities (a brute force approach) although this is not true of the better tests. In most of the tests, once you have figured the problem out, it is no longer a frontal lobe test but simply a matter of applying the solution. In these tests, such individuals cannot be given the test again since it is essentially “spoiled.” Even failure on the tests—by itself—does not indicate a clear diagnosis. For example, if a lower IQ individual cannot find a solution but approaches the test in a flexible manner without signs of rigidity or perseveration, the test may indicate the absence of frontal lobe problems. In these cases, how the client solves the test—right or wrong—may be more important than many of the scores. This can be difficult if not impossible to see in group studies, but is an essential issue in the evaluation of the individual murder suspect.

Kramer et al. (2011) found that high trait aggressive participants were found to evidence more impulsive behavior than low trait aggressive participants on the Tower of London (TOL). A longitudinal study by Barker et al. (2007) reported that frequent physical violence was associated with lower executive functioning and

verbal performance. They studied 698 males and 682 females four times over a span of almost 20 years, with 91 % of the original sample returning at the 4th testing. The study was limited to males. Trajectories for violence indicated that chronically violent adolescents were already engaged in frequent physical violence at age 12; the frequency of this violence increased to a peak at age 18 and then decreased until age 24. As the authors hypothesized, lower cognitive performance, both on executive functioning and verbal performance tasks, was found with frequent physically violent participants. Better cognitive performance for both executive functioning and verbal performance tasks was found within the frequent theft group. Interestingly, the study demonstrated that chronic thieves, even if they used violence, had better neurocognitive abilities than violent individuals as measured by their scores on the Trail Making Test-B, which measures mental flexibility and set-shifting.

Hoaken et al. (2007) conducted a study to analyze the relationship between the ability to encode and interpret social information and how it relates to executive functioning and aggression. They found that violent offender groups performed significantly poorer on a facial-affect recognition task than nonviolent offenders and controls. Additionally, it was found that these poor scores were significantly correlated with executive deficits. Although the violent offenders and nonviolent offenders performed significantly worse than the control group on executive functioning tasks, the difference between the violent offenders and nonviolent offenders was not significant.

A review by Brower and Price (2001) concluded that research has shown a connection between aggressive behavior and brain injury, specifically involving the frontal lobes in individuals with a history of violent and criminal behavior. The review further reported that focal frontal lobe dysfunction was associated with aggressive dyscontrol, but that the increase in risk was less than what is believed to occur. Additionally, the most support was found associating focal prefrontal damage and an impulsive subtype of aggressive behavior. Overall, dysfunction of the prefrontal cortex was associated with increased rates of aggressive and anti-social behavior compared with subjects who had no injury or nonfrontal brain injuries. These findings were also evidenced with prefrontal network deficits in aggressive and antisocial subjects in studies utilizing neuropsychological testing, neurological examination, EEG, and neuroimaging.

Hanlon et al. (2012) found significant differences on executive functioning tasks, as measured by the Wisconsin Card Sorting Test between homicidal schizophrenic and nonviolent schizophrenic individuals. Specifically, differences were noted on the number of categories completed, perseverative errors, and perseverative responses, with the homicidal individuals performing more poorly. Additional executive functioning deficits were noted on FAS (a verbal fluency task) as reflected by a medium effect size. Results suggest that a psychotic individual with deficits in response inhibition may have more difficulty inhibiting aggressive actions, specifically impulsive actions. Also, the tendency to exhibit perseverative thought patterns may translate to the inability to formulate nonviolent alternatives to deal with persecutory delusional beliefs. Lastly, the poor

executive functioning scores in the homicidal schizophrenic patients suggests that, given they have difficulty adjusting their behavior with direct feedback, they may not be able to understand the consequences of their aggressive behavior.

Broomhall (2005) investigated the extent of executive function deficits in a population of 25 violent offenders. The population was separated into primarily instrumental and primarily reactive offenders based on their offense characteristics. Each group was then administered neuropsychological measures which were considered sensitive to executive function impairment. It was hypothesized that there would be evidence of executive dysfunction in the sample and that in comparison with the primarily instrumental group, the primarily reactive group would show significant impairment on the executive function measures. The results supported these hypotheses; the primarily reactive group was significantly impaired on tasks that assessed higher-order executive functions. The primarily instrumental group was largely intact on executive function measures, although it showed a tendency to be selectively impulsive on several executive function measures depending on how important the task was judged to be. These results suggested that primarily reactive offenders may have difficulty controlling their behavior (acquired sociopathy) while primarily instrumental offenders may choose not to control their behavior (selective impulsivity) and may not benefit from behaviorally based treatment. In order to effectively assess and treat violent offenders, consideration of type of violence and integrity of executive function may be important to improve outcomes.

Marsh and Martinovich (2005) researched the role of executive functioning in domestic violence. Their goal was to replicate prior studies linking traumatic brain injury in partner-abusive men and to further demonstrate the occurrence of executive functioning deficits, which have been reported with violent behavior and brain injury. Premorbid intelligence was assessed with the National Adult Reading Test. When the score on the NART indicated a preexisting reading disorder, the premorbid IQ was calculated via the Barona Index. Current intellectual functioning was evaluated with the WAIS-R and the Behavioral Assessment of the Dysexecutives Syndrome (BADS) and Hayling and Brixton tests were used to measure executive functioning. Finally, the Short Michigan Alcoholism Screening Test was used to screen for alcoholism and self-esteem and depression were measured with the Rosenberg Self Esteem Scale. With regard to results, 22 % reported at least one TBI with LOC with severity including 32 % mild, 18 % moderate, and 50 % severe. Results of executive functioning measures showed 18 % impaired on the BADS and 27 % impaired on the Hayling and Brixton tests, although no subjects were found to be impaired on all three tests. The TBI and non-TBI groups were significantly different on the IQ measure, with the TBI group having a lower average IQ than the non-TBI group.

Yechiam et al. (2008) attempted to research the cognitive processes of offenders (81 offenders consisting of violent offenders, drug and sex offenders, drivers operating a vehicle while impaired, and 18 match controls) were evaluated and the results were contrasted with results of neurological patients with focal brain lesions in the orbitofrontal cortex and drug abusers. Utilizing the Iowa Gambling

Task, they found that violent offenders (those charged with assault and/or murder) typically focused on immediate outcomes and made less consistent choices, resulting in poor decision making. Their results were more similar to the patients with orbitofrontal damage. A second study utilizing the Iowa Gambling Task (Levi 2010) found that the irritable and predatory aggressors group exhibited the most difficulty, suggesting these two groups did not learn from environmental feedback. Verbal and design fluency measures were also included as an executive functioning measure, although no significant differences were found between the three groups.

Cohen et al. (1999) attempted to examine impairments in executive functioning among batterers. Results exhibited significant deficits on executive functioning measures such as the WCST and Digit Symbol Coding of the WAIS-R. They also evidenced poorer performance than controls on memory, learning, and verbal skill tasks. Further analysis showed that while traumatic brain injury accounted for some of the variance, it was not the primary factor in the significant findings. Cohen et al. (2003) conducted a follow-up study to further identify correlates of impulsivity among domestic violence offenders. They found significant differences between groups of batterers and nonbatterers on tasks of executive functioning such as the TMT Part B, Stroop Interference Task, Digit Symbol, and the PASAT. No differences were found on Porteus Mazes or TMT Part A.

Hancock et al. (2010) evaluated how executive functioning could predict the frequency and severity of violence. Results evidenced scores below the mean for many of the tasks on the Delis-Kaplan Executive Functioning Scale (D-KEFS) and found that scores from this measure were connected to the severity and frequency of violent offending, but not total offending or nonviolent offending. Poor performance on impulsivity measures were connected to those with a large number of violent offenses. This was also demonstrated on concept formation and cognitive flexibility measures. Furthermore, the more deficits in inhibiting verbal responses, the more likely they committed a serious violent offense.

Brain Imaging

As noted earlier, brain imaging offers an excellent manner of looking at the aggressive individual. However, the results work best with groups of appropriate individuals than with individuals unless used with the clear limitations discussed previously. Despite this, many studies in the area have clearly established the role of neurological deficits in those accused of severe aggression.

Yang and Raine (2009) completed a meta-analytic review on prefrontal structural and functional brain imaging findings in antisocial, violent, and psychopathic individuals. This meta-analysis covered 43 studies and found that antisocial behavior was significantly associated with reduced prefrontal structure and function, specifically the OFC, left DLPFC, and right ACC. Results further indicated that the association between DLPFC reduction was limited to the left

hemisphere; reductions in the ACC and OFC were more prominent in the right hemisphere, suggesting a greater association between antisocial behavior and right-sided prefrontal pathology. Additionally, unilateral lesions to the right ACC tended to cause inhibitory control and emotional processing deficits. No significant results were found regarding the VLPFC and MPFC relating to antisocial behavior.

Tiihonen et al. (2008) compared the regional brain volumes of 26 persistently violent offenders diagnosed with antisocial personality disorder and substance dependence and 25 healthy men. Offenses included 2 murder, 10 manslaughter, 4 attempted murder or manslaughter, 1 assisting manslaughter, 6 assaults, and 3 armed robberies. Additionally, all had recurrent acts of violence in their history and two had previous convictions for violence. It is important to note that one of the offenders had transient unconsciousness due to a head injury, but none of them had previous diagnoses of psychiatric disorder or behavioral disorder as a result of head injury. All of the offenders met criteria for antisocial personality disorder and alcohol abuse and substance dependence. Magnetic resonance imaging volumetry and voxel-based morphometry were used and evidenced significantly larger white matter volumes in both the bilateral occipital and parietal lobes and in the left cerebellum, along with higher gray matter volume in the right cerebellum. Additionally, the researchers found atrophy in the postcentral gyri, frontopolar cortex, and orbitofrontal cortex among the offenders, proving that the increased volumes of the offenders were not believed to be due to psychopathy scores, IQ, psychotropic medication, or substance abuse.

Raine et al. (1994) studied cerebral uptake of glucose in 22 subjects accused of murder and 22 age and gender-matched controls to test for prefrontal dysfunction. This was completed by using positron emission tomography while the participants were completing a continuous performance task. Findings showed significantly lower lateral and medial prefrontal glucose metabolism in the murders than the control group. They further concluded that “no group differences were observed for posterior frontal, temporal, and parietal glucose metabolism, indicating regional specificity for the prefrontal deficit.” While these results are limited regarding generalizability due to the small sample size, the results are significant.

A follow-up by Raine et al. (1997) examined murders who pleaded not guilty by reason of insanity (NGRI). The purpose of the study was to see if there was evidence of brain dysfunction in this specific cohort. Positron emission tomography brain imaging using a continuous performance challenge task compared 41 NGRI subjects to 41 matched normal. The use of the challenge task was important so that the subjects were engaged in similar cognitive activities during the evaluation. The results indicated that the NGRU group showed reduced metabolism across a wide variety of areas including the prefrontal cortex, superior parietal gyrus, left angular gyrus, and the corpus callosum, while certain structures showed more impairment in the left hemisphere than the right hemisphere. These structures included the amygdala, thalamus, and medial temporal lobe. It is unclear whether the fact that these individuals who pleaded NGRI would make them neurologically different from others who committed similar murders.

Blake et al. (1995) evaluated neurologic abnormalities in subjects charged with murder, who were sent by attorneys for mitigation. They found that 64.5 % of the subjects evidenced physical signs, such as decrease in word fluency, reciprocal hand movement errors, and reflexes that suggested frontal deficits. The authors conducted a retrospective chart review, and found that frontal lobe lesion was the best predictor of violent episodes among inpatients, accounting for 11 % of the variance.

Wiswede et al. (2011) attempted to create an experimental paradigm in a laboratory setting dealing with relating EEG changes to ways in which violent and nonviolent individuals handle induced aggression. The subjects were not criminals. They utilized the Taylor Aggression Paradigm (TAP), which is a “competitive reaction time task in which the participant competes against an opponent. In case of winning, the participant is asked to punish the opponent. In case of losing, the participant is punished by the opponent.” During the decision phase, when they were asked to select the strength of the punishment, the frontal P200 was more pronounced for violent participants. The researchers’ data suggested that the planning of aggression is associated with “distinct brain activity and that such activity is differentially represented in violent and non-violent individuals.”

Aigner et al. (2000) examined 96 mentally ill offenders in a high security prison who underwent magnetic resonance imaging of the brain (MRI). Five-eighths of the sample were sex offenders, but 14 were excluded because they had a history of neurological disease, a psychotic disorder, a severe organic mental disorder, or they were older than 60 years, a procedure which would lessen the incidence of neuropsychological dysfunction in this population. All scan reports were in narrative format, and they were reviewed and coded according to presence or absence of brain abnormality. Neuroradiologists were blind to clinical diagnoses and offense history. Offenders were classified based on history as either a “high violent group” or to a “no or low violent group.” There was no significant difference in age between groups. Just under one half of the group was seen as having MRI abnormalities. However, nearly 2/3 of the high violent group showed abnormalities while only one sixth of the low violent group were reported as having abnormalities. In the high violent group, 65.5 % showed MRI abnormalities compared with 16.6 % in the low violent group. There was no significant difference in MRI abnormality based on whether the individual was also classified as a sex offender. The results were consistent with a role for neurological abnormalities in individuals classified as violent. However, the study did not correlate such findings with the presence or absence of neuropsychological disorders, nor was the location or nature of the abnormalities indicated.

The neuroradiological data clearly support that there is an abnormally high rate of neurological dysfunction in violent individuals, most frequently in the anterior frontal-temporal areas of the brain and in the left hemisphere, although these disorders may be part of a larger and more extensive brain dysfunction. Some of the research has been linked and supported by correlations with neuropsychological and behavioral data, but this has not been consistent.

When using neuroradiological findings with real-world clients, the results cannot be used by themselves. Clearly, the presence of brain injury itself does not predict violence or provide an explanation of why someone committed violence without integrating neuropsychological data, environment, history, the circumstances of the crime, and other data relevant to the particular circumstances of an individual case. In court, it is often argued that since all people with brain injury, or all people with frontal injuries do not commit murder or even violence, then there is no role for such injuries in explaining violence. Similarly, others have argued that simply because an individual has a brain injury as confirmed by a neuroradiological test or a neuropsychological test then that explains their violence. Both of these arguments are fallacious, and in court simply act as a way of distracting the judge or jury from the more fundamental and important issues which underlie any given case. It is essential that neuropsychologists do not support such arguments for whatever side they represent as this allows these fallacies to be taken seriously.

Personality

The role of personality in the neuropsychological evaluation has always been somewhat ambiguous, often not seen as a central purpose but more to rule out psychotic disorders or malingering and exaggeration in a client. This is a curious problem as personality and emotional functioning are as much aspects of neurological and neuropsychological functioning as are cognitive skills. One difficulty with personality is that it is much harder to measure effectively and to fully quantify. In addition, personality is much more complex to relate to specific neurological processes and locations, as many areas—including those involved in information processing and integration—are involved in determining personality. Personality is seen as being shaped more strongly by environment, although Luria (1966) and others would argue that cognitive skills, especially those which are more complex, are also heavily influenced by environment, but that the relationship between cognitive style and processes with environment may be less easily observed.

Personality also offers a challenge in that how one expresses personality traits and emotions may be more situationally determined. A client may be very aggressive when working with females, but very passive when working with males. The passivity with males may only be seen with males in positions of physical and/or administrative power rather than all males. An individual may be aggressive only when around others who encourage or model aggression, but otherwise be passive. Such variations in personality are not easily captured by a single number or the pathological dimensions typically captured in tests like the PAI or MMPI-2.

This is further exacerbated by the reliance only on tests which are seen as objective and a rejection of projective tests. In the earlier days of these evaluations,

projective tests like the Rorschach or Bender were seen much more frequently. However, psychologists were often uncomfortable with defending these measures because they were afraid they would not meet the necessary standards for being included in a court evaluation. Oddly enough, in neuroradiology the primary focus has always primarily been on qualitative, impressionistic reviews of patient data and there has been a resistance to the use of data-based, statistical analyses (although such presentations can be quite impressive). The physician would argue that the tests are simply a tool and that the expertise lies in their own knowledge and training. Neuropsychologists have often been trapped (or willingly offered) into putting the expertise on the test, not on the neuropsychologist. This is an issue which must be considered when presenting testimony and test results.

The advantages of projective tests to enhance the neuropsychological evaluation are several. Objective tests limit us by their nature to looking only at certain questions and certain dimensions, most of which are pathological rather than aimed at how a person interacts with others and processes information in social interactions (Aggression is most often the result of social interactions although not necessarily pleasant ones.). This information can be essential in putting together an individualized formulation of how and why a crime occurred. In addition, objective tests rely on the self-report of the individual. An individual may believe that they are telling the truth in the evaluation but, in fact, they may be reporting a distortion of reality that they rely on for their survival and self-esteem. The authors have always impressed how death row clients would rather be executed than deal realistically with events in their lives, even when those events are clearly documented. This is especially a problem in well-defended clients with normal to above average intelligence who are capable of looking normal in most aspects of their life.

Projective tests allow us to look at underlying personality processes that are much harder to hide as socially acceptable answers on such tests are not as clear as on objective tests, even for reasonably intelligent clients. When clients inadvertently reveal such processes, they are often not aware of what they have done or the importance of the information. In the cases of malingerers, malingering is much more difficult to disguise on these tests short of refusing to cooperate which does occur.

Projective tests have limits as well. The scores generated by such tests are often nonlinear scores which are not easily analyzed by traditional statistical analyses leading to problems with the research literature unless this is understood. For example, in the Exner Rorschach, Lambda scores in the middle are normal while high or low scores may reflect similar dysfunction under the right circumstances. Thus, we cannot run a correlation where high scores represent pathology and low scores represent good performance. In addition, accurate interpretation requires not looking for elevations on single scores but rather complex patterns of scores, each of which may have a different interpretation depending on the context of other scores. This requires extensive experience with interpreting the test in these populations, something which is no longer frequently taught because of the need to emphasize the scientific rather than the clinical side of our skills.

While research relating personality and aggression is common, research relating this to neuropsychological functioning is less common. Hartman et al. (2006) found significant differences between psychopathic violent offenders and non-psychopathic violent offenders suggesting more aggressive, cognitive, and interpersonal difficulties among psychopathic violent offenders, as measured by the Rorschach. The psychopathic violent offenders scored significantly higher on scores like M- and CF + C-FC and significantly lower on P and XA%. The authors concluded that these results indicated greater aggression, poor interpersonal skills, and problems with emotional controls. Violent offenders scored significantly higher than university students and inpatient schizophrenics on aggressive measures.

Levi et al. (2010) assessed predatory, irritable, and nonviolent offenders to determine if there were significant differences on measures of trait anxiety, trait anger, and five subscales from the Personality Assessment Inventory (PAI). Significant differences were found on the STAXI-II Trait Anger and the PAI Drug, Aggressive Attitude, Verbal Aggression, and Physical Aggression subscales. They found greater elevations in subjects classified as irritable aggressors compared to subjects classified as predatory aggressors. Most of the PAI subscales adequately discriminated between the aggressive and nonaggressive participants. Notably, the PAI Aggressive Attitude scale was the only measure that successfully discriminated among all three groups.

A longitudinal study of 132 juvenile males, adjudicated delinquent and residing in a juvenile justice facility found that MMPI-A scores and IQ were not able to predict nonviolent offending, however the Hysteria, Anxiety, Anger, Low Self-Esteem, Brooding, Persecutory Ideas, and Deficient Inhibition scales were able to significantly predict future violent offenses, suggesting that personality characteristics are strong predictors (Parker et al. 2005). It was noted that they exhibited personality characteristics such as poor emotional control, impulsivity, and difficulty in forming close relationships.

Edwards et al. (2003) explored impulsiveness in spousal abusers in an attempt to demonstrate the relationship between impulsiveness, impulsive aggression, and physical violence. Impulsiveness and impulsive aggression had significant correlations with physical aggression. Impulsiveness and impulsive aggression were correlated with measures of Borderline Personality Disorder and Antisocial Personality Disorder. The violent and nonviolent groups differed on impulsive aggression and on Borderline Personality Disorder. A high violence group had higher pathology scores on nearly all clinical scales of the Personality Assessment Inventory.

A 1999 study (Valliant et al.) examined risk factors in violent and nonviolent offenders. Results evidenced offenders with violent crimes were elevated on the Psychopathic Deviate, Paranoia, and Schizophrenia scale of the MMPI-2. Test age quotient scores were lower on the Porteus Maze task. They further demonstrated elevated scores on the Psychopathy Checklist Revised psychopathic orientation and violence risk of the Violence Risk Scale.

Barkataki et al. (2012) investigated individuals with antisocial personality disorder (APD) and violent and nonviolent individuals with a diagnosis of schizophrenia. Overall, four groups were looked at (1) those with APD and a history of serious violence; (2) those with a diagnosis of schizophrenia and a history of violence; (3) those with a schizophrenia diagnosis and no history of violence, and (4) healthy controls. A neuropsychological battery designed to investigate intelligence, memory, executive functioning, processing, and attention was utilized. Regarding intelligence, there were statistically significant group differences for performance and verbal IQ scores. PIQ and VIQ scores were lower in schizophrenia groups as compared to the controls and the APD group performed lower than controls, but better than the violent schizophrenia group. Mean FSIQ scores were significantly higher for the APD than the Violent Schizophrenia (VS) group and both schizophrenia groups showed lower FSIQ scores than the control group.

On memory measures, those with antisocial personality disorder performed significantly better than the violent and nonviolent schizophrenia group on Logical Memory I and II. There were no differences between the APD and control groups, however the VS and NonViolent Schizophrenia (NVS) groups performed significantly worse than controls. On executive functioning measures, the NVS and VS groups made more perseverative errors than the APD and control groups.

Performance on the Stroop processing score showed significant differences. Both the NVS and VS groups exhibited lower processing scores than the control group while APD scores were comparable to control and NVS groups. Performance on a measure of attention, the Continuous Performance Test, evidenced poorer performance for the NVS and VS groups as compared to controls. No significant differences were found between the APD and control group. Lastly, there were significant group differences on processing speed scores as the APD, NVS, and VS groups all showed significant impairment when compared to the control group. No significant differences were found on measures of motor speed.

This was an interesting study in its attempt to relate violence, personality, and neuropsychological measures. Unfortunately, the test battery was limited and did not include a wide range of executive measures. A reliance on the Wechsler tests is very traditional, but does not always address the necessary questions. This is even more limited when the focus is on index scores rather than subtest scores. Also, while schizophrenia is a dimension of personality pathology, it is a very broad group which includes individuals with a wide range of neurobiological etiologies and a wide range of neuroradiological abnormalities. As a result, generalization of results can be very difficult.

Malingering

Malingering and exaggeration is an important and necessary dimension of any forensic case in which a neurological or psychiatric pathology is claimed by a client or their attorney. Such exams should rely on multiple measures of

malingerer rather than single measures as was often done in the past. It would be appropriate as well to include both embedded and stand-alone measures whenever possible as well as both verbal (such as the SIRS) as well as performance measures (such as the TOMM or MSVT). Research with individuals accused of extreme aggression is rare at present, although the authors have been impressed clinically at a very low rate of malingering in this population.

When looking at malingering, one must also be clear to recognize that malingering is a deliberate (conscious) attempt to mislead, not just a belief on the part of the client that they are very impaired which may elevate scores on tests like the MMPI-2. In some cases, the patient's distress may cause an overreaction to their situation leading to impairment across a wide variety of tests in a manner inconsistent with their actual potential. However, in cases like this, such performance is not deliberate and, thus, does not represent malingering but rather invalidity. This phenomenon is seen more frequently in civil rather than criminal cases but must be considered when examining individuals in these cases,

Myers et al. (2012) researched the prevalence and assessment of malingering in homicide defendants. The researchers utilized the Mini-Mental State Examination (MMSE) and the Rey 15-Item Memory Test (FIT). Results demonstrated a malingering rate of 17 % within the sample. In attempting to determine the worth of utilizing the MMSE and FIT, it was found that MMSE and FIT scores were highly correlated. However, scores on these tasks were only able to identify two-thirds and one-half of the malingering cases. Interestingly, the MMSE proved to better detect malingering than the FIT. This is surprising as the MMSE is traditionally a bedside measure of cognition, not a malingering test. It was able to identify two-thirds of the malingering cases. Overall, there was no significant advantage to utilizing both tasks together to aid in the detection of malingering.

Miscellaneous

Jovanovic et al. (2012) researched inmates convicted of homicidal and nonhomicide acts to determine if there was a significant difference in intelligence between the two groups. The 60 homicide offenders and 60 nonhomicide offenders were from the Correctional institutes of Republic of Srpska and Court Department of Psychiatry Clinic Sokolac. The mean intelligence of inmates (homicidal and nonhomicidal) was found to be 95.7. The intelligence of homicide inmates was 97.4 and nonhomicide inmates was 94.09. With regard to Verbal intellectual ability, the homicide inmates was 91.22, and nonhomicide inmates was 91.10. Nonverbal or manipulative IQs were average within both groups.

Langevin and Cunroe (2013) examined a sample of 1,533 sex offenders (based on files from 1966 to 2009) to determine if a psychological profile of sex offenders using weapons in their crimes existed. Psychological tests such as the MMPI, MMPI-II, MCMI-II, and MCMI-III were evaluated. Also, two independent raters

completed the PCL-R (obtaining scores within three points of each other) and Hare's cutoff score of 30 was used to determine psychopathy. ADHD was diagnosed using DSM-IV-TR criteria, and the CAARS was supplemented to aid in that diagnoses for recent cases. Additionally, cognitive functioning was evaluated with Halstead-Reitan Neuropsychological Test Battery (1,993 norms), with the WAIS-R used for testing intelligence. The researchers used clinical files, interviews, and other methods to determine a history of neurological impairment, head injury, learning disorders, etc. Results determined that with 29.4 % of the offenders using a weapon, the most frequently used weapon was a knife (50.1 %) followed by firearms (25.2 %), other objects such as bats (29.1 %) and unspecified (9.7 %). They found that those using weapons were significantly less educated, more were placed in special education, were less intelligent (important to note that mean IQ of both groups were within average range). Furthermore, while both groups had more learning disorders than the general population, weapon users had twice as many as nonweapon users. Lastly, significantly more weapon users had been rendered unconscious in the past.

Dolan et al. (2002) tested their hypothesis that there would be no difference in neuropsychological test performance if the subjects were matched on several factors such as intelligence, personality, and age, specifically, if the researchers controlled for impulsive aggressive traits, substance abuse and performance anxiety. They gave a battery of frontal and temporal neuropsychological tests to 27 violent offenders, 20 sex offenders, and 13 arson offenders who met DSM-III-R criteria for a personality disorder diagnosis. Results showed that sex offenders received higher scores on trait anxiety, depression, and tension measures. However, the groups did not exhibit significant differences on neuropsychological tests, with the exception of poorer perseverative error scores by arsonists on the WCST.

This brings up two major issues. First, controlling for such factors as intelligence, aggression, and impulsivity will control for neurological impairment as well since these factors are correlated with one another. Second, not all individuals with frontal-temporal or other brain injuries will develop serious aggression. They may for a wide variety of environmental, historical, and personal reasons develop other disorders such as arson, OCD, generalized anxiety, schizophrenia, bipolar disorder, and so on. The presence of a brain injury may increase the likelihood of violence, but recognize that the rate of serious violence in the "normal" as well as impaired populations is very low.

Levi et al. (2010) set out to classify offenders into predatory, irritable, and nonviolent offenders. They hypothesized that scores on personality and executive functioning measures would aid in differentiating violent from nonviolent offenders. Eighty-nine male inmates were voluntarily recruited from a Correctional Institute. Exclusions included non-English speakers, a file indicating the presence of a DSM-IV Axis I disorder, and a Full Scale quotient less than 80 on the Multidimensional Aptitude Battery-II (MAB-II). Statistical procedures did not find a significant difference between the two violent groups on age, education, or MAB-II verbal, performance, or Full Scale IQ. However, significant differences were found in that the nonaggressive participants were older, had higher education,

and scored significantly higher on all three aspects of the MAB-II than the aggression groups.

The authors used discriminant analyses, based on test results, to differentiate all violent offenders from nonviolent offenders and selected and retained five variables: Letter Fluency, IVA Full Scale Attention Quotient, TCI Cooperativeness Scale, STAXI-II Trait Anger, and Block 5 from the IGT. The discriminant analysis, based on the aforementioned variables, was able to classify 84.2 % of the aggressive participants and 73.3 % of the nonaggressive participants, leading to an overall success rate of 80.5 %. A second discriminate analysis was utilized in an attempt to discriminate between predatory and irritable aggressors. This included six variables: PAI Drug Scale, PAI Aggressive Attitudes scale, PAI Physical Aggression scale, IVA Full Scale Attention, and STAXI-II Trait Anger, which allowed for a classification success rate of 78.1 % of irritable offenders, 68 % of predatory offenders, and an overall classification success rate of 73.7 %. The study concluded that discrimination between these offender types could be successfully negotiated with a selected battery of neuropsychological tests.

Baker and Ireland (2007) investigated the association between dyslexia, impulsivity, self-esteem, and executive functioning within offender and nonoffender samples. Results indicated that offenders were more likely to exhibit dyslexic traits than nonoffenders, with violent offenders exhibiting significantly more traits than nonviolent offenders. Similarly, offenders performed poorer on executive functioning tasks such as the Benton Word Fluency Test. However, no significant differences were found on a measure of impulsivity, the Barratt Impulsiveness Scale-Version 11. Overall, dyslexic traits proved to predict offenders, where self-esteem, executive functioning, and impulsivity did not. The presence of dyslexia would likely suggest the strong possibility of left hemisphere dysfunction which may have been life long in these individuals.

Lally (2003) conducted a survey to determine which tests were considered to be most acceptable to be used in forensic evaluations. Sixty-four diplomates in forensic psychology were surveyed about the frequency with which they utilized assessments and what their opinions were about the acceptability of psychological tests in 6 areas: mental state at offense, risk for violence, competency to stand trial, risk for sexual violence, malingering, and competency to waive Miranda rights. Regarding evaluating an individual's mental state at the time of the offense, acceptable tests included the MMPI-2, PAI, MCMI-III, WAIS-III, Stanford-Binet-Revised, Halstead-Reitan, and Luria-Nebraska were rated as acceptable. In the equivocal-unacceptable category were the 16PF and Rorschach and unacceptable tests included projective drawings, sentence completion, and the TAT.

When conducting risk for violence evaluations, only the PCL-R was rated as recommended, with the MMPI-2, WAIS-III, and PAI, were rated as acceptable. Regarding risk for sexual violence, the PCL-R, MMPI-2, PAI, and WAIS-III were rated as acceptable, while the PCL-R was recommended. Within competency to stand trial evaluations, the WAIS-III and MacCat-CA were rated as recommended and the CAI, CST, MMPI-2, Halstead-Reitan, Stanford-Binet-Revised, PAI, and Luria-Nebraska were rated as acceptable. Projective drawings, TAT, sentence

completion, Rorschach, and 16PF were rated as unacceptable. Lastly, within malingering evaluations, the MMPI-2 and SIRS were rated as acceptable, and the WAIS-III, Rey, PAI, TOMM, and Halstead-Reitan were rated as acceptable.

Interpretation of these results must be cautious in that few forensic diplomats are also diplomats in neuropsychology. The goal of their testing is more focused on issues other than mitigation and an understanding of why a crime was committed. Rather, they focus on whether a client meets certain statutory or legal requirements or whether future violence can be predicted.

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