

The Gifted Brain

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Outside the classroom, the rain is hitting the window. Inside, Max taps his foot in time to the rhythm of the rain and fiddles at his desk. In silence, the rest of the class works on their assigned math problems. Max has completed his work perfectly in a fraction of the time allotted and begins tapping his pencil, much to the annoyance of those around him. Max seems unaware that his habits annoy people, and he is equally annoyed by his classmates. Though he longs for friends at school, he is perplexed about how to relate to the other students socially because his interests are completely different than theirs. Unaware that he is done with his work, Max's teacher, Ms. Gomez, gently touches him on the shoulder and signals for him to be quiet and still. She is not the first teacher to have talked to Max's parents about ADHD, but Max's parents are resistant to the idea that there is something "wrong" with Max because he does not behave the same way at home. While Max's physical intensity aggravates the other students so much that they avoid him, like most adults, Ms. Gomez feels sorry for him because he can't seem to control himself. She worries about what will become of Max given his inability to connect with his classmates and stay focused in school.

On the other end of the room, Audrey squeezes a stress ball and solves the first math problem with a novel method. By the time the rest of the class is done, Audrey has completed only half the problems and takes the rest home to finish. The next day, Audrey will be saddened to receive a "C" on the worksheet she spent so much effort on. The teacher explains that although Audrey got the answers correct, she did not do the problems according to the examples. While her mathematical innovation is impressive, her work is hard to follow due to her poor handwriting, and she must take the time to demonstrate her understanding of the lower foundations of math if she is ever going to succeed at the upper math levels. She assigns Audrey an extra sheet of lower level practice problems to re-enforce her foundational math knowledge. Though Audrey can talk fluently about mathematical theories many years beyond her grade level, she is often in danger of failing because she is unable to finish her tests on time. Despite her hard work and fascination with math, Audrey is crushed by her low math grades. Audrey's parents recently had her tested for a nationwide talent search, and based on those test scores, the local chapter invited her to join their competitive math team. While thrilled to be noticed, Audrey turned it down because she did not think she was good enough and was afraid she would let the rest of the team down.

After lunch, while doing a lesson on Columbus, Kyle is unable to stop interrupting the class discussion, continuously challenging the facts Ms. Gomez is presenting to the class. Eventually he becomes so worked up about the textbook's neglect to mention Columbus's effect on the Native Americans that she sends him

to the office to calm down. When Kyle applies himself, he almost always scores 100 percent. However, he rarely does his homework, and when he does, it is messy and filled with careless errors. Kyle's parents are frequently emailing the school to discuss ways to motivate him, and his father has expressed his frustration about how "lazy" Kyle seems. At school, his teachers have tried both punishment and reward. The school even had him evaluated by the district behaviorist, but there has been little consistent improvement in his classroom achievement. The other kids seem to like Kyle, but adults are often frustrated by his tendency to argue over seemingly minor injustices and inaccuracies. Ms. Gomez was recently relieved to learn that Kyle's parents have started him on medication and hopes it will help him focus, settle down and stop interrupting class.

Turning her attention to Elaine, Ms. Gomez breathes a sigh of relief. Elaine is an easy student for a teacher. As usual, Elaine completes her in class essay on time with perfect grammar and penmanship. Elaine always finishes with plenty of time to spare and then either reads quietly at her desk or looks around to see if there is someone who needs help understanding the assignment. Seen as a leader by her peers, Elaine recently organized the GATE kids' participation in a local math competition. Sensing that Ms. Gomez was often overwhelmed by grading so many papers, Elaine offers to stay in during lunch to help finish the grading. Despite how well she performs in school, Elaine's parents are worried, because she is often up into the wee hours of the morning, overworking her assignments. While Elaine

never lets it show at school, she feels like a failure when she is unable to live up to her impossibly high self-imposed standards.

What Ms. Gomez and the other teachers at Oak Elementary School don't realize is that Max, Audrey, Elaine, and Kyle are all highly gifted. Like most people, they have little understanding of what giftedness really is and the many ways it affects an individual. While these examples of giftedness in the classroom are composites, the behaviors and issues they depict are very real.

Defining Giftedness

There is no single definition of giftedness accepted by all professions, though it is usually measured in one of three ways: achievement (measures what a person "knows"), Intelligence Quotient, commonly called IQ (measures a person's ability to "understand" things as opposed to what they "know"), or talent (an outstanding ability or aptitude often used in reference to athletics and the arts). However, gifted individuals, as well as those who work with them, frequently describe giftedness in much broader terms. They note that giftedness is best conceptualized as how a person experiences and responds to the world. Gifted individuals experience, process and respond to the world in ways that are qualitatively different. It is important to note that GRO believes that the expression of giftedness in terms of eminence, achievement and success is highly individual. One does not have to be gifted to be high achieving, eminent or successful. Conversely, just because one is gifted does not mean that they will become high achieving, eminent or successful.

As an organization, GRO favors the Columbus Group definition of giftedness:

“Giftedness is asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm. This asynchrony increases with higher intellectual capacity. The uniqueness of the gifted renders them particularly vulnerable and requires modifications in parenting, teaching, and counseling in order for them to develop optimally.”

It is important to note that while GRO uses the Columbus Group definition of giftedness, the majority of existing research on intelligence uses IQ. Specifically, IQ continues to be the most common measure of intelligence as a variable in scientific research. While we realize that IQ does not capture all gifted individuals, it provides a consistent scientific baseline for comparing differences across groups. Because of this, the studies reviewed represent an incomplete, but not inaccurate, representation of the gifted population. Specifically, the studies GRO reviewed used the following IQ assessment instruments: Raven Progressive Matrices, Wechsler Intelligence Scale for Children (WISC) Wechsler Adult Intelligence Scale (WAIS).

Those who work with gifted individuals often reference the work of Kazimierz Dabrowski, a Polish psychologist and psychiatrist who created the “Theory of Positive Disintegration.” The gifted community has embraced a portion of his work because it provides a vocabulary and framework to describe experiences common among gifted individuals. Because of this, GRO felt it was important to provide a brief explanation of how Dabrowski’s work is understood and utilized in the gifted community. While not specifically a theory of giftedness, two applications of his work frequently applied to the study of giftedness are the concept of positive

disintegration and his observations of what are commonly referred to today as over-excitabilities (OEs).

Largely unknown in the fields of education and mental health, Dabrowski's Theory of Positive Disintegration (TPD) (Dabrowski 1964, 1967, 1970, 1972), refers to the idea that one needs to become disillusioned with their current level of psychological development in order to reach and reintegrate at a higher level. While the theory of positive disintegration is far too complex to be included in this article, it is important to note that many gifted individuals report having early and significant "existential crises".

Dabrowski's observation and documentation of the OEs provides vocabulary that many find to be the best description of the gifted experience. Specifically, an over-excitability is "an innate tendency to respond in an intensified manner to various forms of stimuli, both external and internal" (Piechowski, 1979, 1999). Essentially, this means a person has a stronger reaction than normal for a longer period of time to a stimulus that may be small or imperceptible to others. Dabrowski noted five areas of increased sensitivities that appeared to be more prevalent in individuals with "superior abilities" (higher intellectual capacity). The five OEs are: Psychomotor OE, Sensual OE, Intellectual OE, Emotional OE, and Imaginational OE.

- *Psychomotor OE* is best described by an enhanced excitability of motor function. These are the children that are constantly active, have high energy levels, speak rapidly, need vigorous physical activity and have the

desire for constant action (Dabrowski & Piechowski, 1977; Piechowski, 1979, 1991).

- *Sensual OE* is described as an elevated experience of sensory input originating from hearing, smell, touch, taste, and sight that can be enjoyable or painful (Dabrowski & Piechowski, 1977; Piechowski, 1979, 1991).
- *Intellectual OE* is marked by a prominent desire to gain knowledge, search for and understand the truth and to analyze and synthesize information (Dabrowski & Piechowski, 1977; Piechowski, 1979, 1991).
- *Emotional OE* is displayed by increased intense feelings, the ability for complex emotions, a strong ability for empathy and deep emotional expression (Piechowski, 1991).
- *Imaginational OE* is described as enhanced imaginational play and the creation of worlds where fantasy and reality blend, have imaginary friends and are dreamers (Dabrowski & Piechowski, 1977; Piechowski, 1979, 1991).

In the initial phase of its literature review, GRO focused on understanding the gifted brain. Neuroscience research supports the belief that gifted individuals have increased intellectual, emotional, sensory and motor processing capacity. This article explains the differences in brain physiology and activity that might account for gifted intensities and behaviors, as well as provides insight into how gifted individuals experience the world.

Neuroscience of the Gifted Brain

The neuroanatomy of gifted individuals differs from that of the general population in six ways that play a critical role in their heightened experiences.

Specifically, existing research indicates that gifted individuals have:

1. Increased regional brain volumes.
2. Greater connectivity across brain regions.
3. Brains that operate more efficiently.
4. Greater sensory sensitivity.
5. Expanded brain areas dedicated to emotional intelligence.
6. Expanded brain areas that respond more actively to challenges.

Individuals with higher IQ have increased grey matter volume in various regions of the brain. Grey matter is the part of the brain used to compute information and it is what the cortex is composed of. The regions with increased volume include the frontal lobes (complex decision making and hypothesis testing), temporal lobes (auditory processing and language interpretation), parietal lobes (taste, temperature, touch sensation), and occipital lobes (visual information). These increased regional brain volumes may account for the ability of gifted individuals to make decisions quickly, especially decisions involving large volumes of information. The increase may also explain the greater sensitivity to sensory stimuli noted by many in the gifted population.

Many researchers over the years have tried to explain giftedness as having a “big brain.” This approach to intelligence is overly simplistic and

inaccurate. Twenty-eight regions of the brain are known to be involved in intelligence. It is the collective of these networks and their functioning that differ from one individual to another. We often use the phrases “left brain” or “right brain” to describe scientific or artistic tendencies of individuals, but in fact, it is the complex interaction of brain networks that allows individuals to solve problems and navigate through the world. Although this neurodiversity exists across the intelligence spectrum, it may provide particular insight into gifted asynchronous development.

Connectivity in the brain is analogous to a freeway system and is aptly referred to as the information highway. White matter tracts relay information across the brain to different regions and are critical to processing speed and information transfer. Gifted individuals have increased white matter tracts compared to the general population. Having greater connectivity could explain increased processing speed in the gifted population. Conversely, the increased white matter tracts seen in high IQ individuals could also be related to a decrease in processing speed due to the abundance of networks used for processing information. This may explain why some gifted children take longer than their classmates to complete schoolwork. Like a traffic jam, when many cars from multiple freeways converge at rush hour, the gifted brain is flooded with alternative ideas making it difficult to respond with a simple answer in a timely manner. The relationship between white matter connections and information processing speed, faster or slower, is not yet fully understood.

Gifted children need fewer repetitions when learning a new task. In school, most students need eight to ten repetitions to acquire mastery, but gifted students often need only one to two. This is thought to be related to greater neural efficiency. One measure of neural efficiency is glucose utilization. Higher IQ subjects were shown to utilize less glucose once they had mastered a task. Researchers have interpreted this to mean that intelligence can be measured by how efficiently the brain works as compared to how hard the brain works. This also means that gifted children are not operating at their full potential once they have mastered a task, and may explain why they are often resistant to repetitive school work.

The brains of gifted children respond more intensely to sound, both in the amplitude and duration, than the brains of the general population. While the study was limited to auditory response, gifted children have been observed to have increased sensitivity to all types of sensory input including touch, taste, smell, hearing and vision. This intensified sensory response can be experienced as either pleasurable or painful. For example, these are the individuals who especially enjoy fine food since they have a heightened ability to identify the subtle differences in texture and flavor. On the contrary, others with enhanced sensibilities may find flavors to be too strong or textures unpalatable, responding with discomfort or even disgust.

The brain areas essential for processing emotional information are expanded in gifted individuals. The expansion and enhanced connectivity of the anterior

cingulate cortex (ACC) and frontal cortex (FC) could account for the intense drive to satisfy intellectual curiosity. This expansion and greater connectivity may also explain why gifted individuals seem to use emotional information differently, in that emotional information permeates all areas of intellectual functioning. It may also explain the frequency with which high IQ individuals experience heightened emotional responses including depression and anxiety. In other words, both drive and anxiety might be hardwired.

Brain functioning accelerates with intellectual challenge in gifted individuals. Mathematically gifted adolescents have larger areas of the brain that are responsible for executive function (right ACC), interpretation of sensory information (left parietal lobe), and motor function (left premotor area). Additionally, they show an increased number of white matter tracts that connect frontal regions with the basal ganglia (the part of the brain that is highly sensitive to reward and decision making) and parietal regions, (which account for increased fluid reasoning, working memory, and creativity). This means that gifted students have brains that may be larger in areas that are involved in managing information more efficiently. Significantly, the gifted brain is further activated when presented with increased challenge. It is not just the size or the activation but rather the ability of the brain to utilize these parts in qualitatively unique and more complex ways that ultimately account for the differences seen in approaches to challenge and problem solving.

When presented with increased challenge, the gifted brain exhibits greater bilateral brain activation than the general population. The greater activation with greater challenge, described as the brain in a peak state, could be likened to what is thought of as the experience of being in the state of “flow,” and may explain the “rage to learn” which is almost universally considered to be a hallmark of giftedness.

While gifted children require challenge to perform at their optimal level, we must be aware that “challenge” is in the eye of the beholder. These students need to be challenged not based on age, grade or test scores, but based on work that allows each individual to operate at a high level of intellectual functioning. When gifted students are given adequate intellectual challenge and support, many of their “emotional” and behavior challenges are lessened if not eliminated.

The Human Impact

Remember our children in the classroom? Here are examples of potential outcomes when gifted children’s needs are met, are misdiagnosed, incorrectly medicated, and are strictly focused on achievement.

Max’s parents decided to pull Max out of school before he entered seventh grade. They were fortunate to have found resources to help them better understand the emotional aspects of giftedness, and while they were terrified to homeschool, they felt it was better than watching Max lose his love of learning and become emotionally damaged from being ostracized by his classmates. While they knew Max was “smart,” they were astounded by the rate and depth at which Max

mastered material when he was allowed to self-pace. The insatiable hunger for knowledge he had when he entered kindergarten returned, and he completed six years of education in just two years. Max entered a university full-time at the age of fourteen, and for the first time in his life developed the confidence and friendships that come with finding true peers. Today Max runs his own bio-technology company and is married to a woman he met in his doctoral program. For Max, self-pacing and acceleration, done in a thoughtful and comprehensive manner, had positive social, emotional and professional outcomes. Ms. Gomez's fears that he would never fit in were unfounded, he just needed to find his social, emotional and educational tribe.

Audrey's path was more difficult. Both her parents worked hard to support not only her and her three other siblings, but also an ailing extended family member. Her parents had not had the opportunity to pursue higher education, but were doing everything in their power to afford their daughter the opportunity they missed. They were at a loss to understand why Audrey, who was obviously so intelligent, was also so unhappy and seemed to struggle more and more as she progressed through school. Even though all of her teachers agreed she was brilliant, Audrey never qualified for the gifted program at her school because her grades reflected her struggle to complete her work on time. Conversely, because her intelligence allowed her to compensate, she was able to pass her classes and thus was also never tested for learning issues. Audrey's frustration grew to anxiety, and in the eleventh grade, she had a nervous breakdown. While

hospitalized, she was given a complete neuro-psych examination, which revealed dyslexia as well as low processing speed, compared to her very high intelligence. Armed with knowledge about how to support Audrey, her parents were able to help Audrey regain her confidence and she became the first person in her family to attend college. While it took her longer to finish her degree, due to her need to both work and carry a lighter course load, Audrey graduated with a dual degree in art and engineering and is loving her career at a cutting-edge company designing robotic assistance devices for the elderly. Audrey's experience as a twice exceptional student (children who are both gifted and have learning challenges) exemplifies how the needs of gifted/twice exceptional students from lower socioeconomic levels can often be overlooked, misunderstood, and mis-diagnosed due to the lack of accurate awareness of the complexities of giftedness.

Worried and perplexed, Kyle's parents took him to multiple therapists and specialists trying to figure out why he did not, or could not, perform like his peers despite his obvious ability to do so. Therapist after therapist, medication after medication, Kyle remained determined to do things his way, and little changed except his parents' bank account. Then, after years of being told he wasn't trying hard enough, Kyle stopped trying all together and turned to drugs to dull his existence in the world. Kyle's parents were both surprised and pleased when he took a couple of free on-line college courses in statistics and economics. What they didn't know was that Kyle used this knowledge to set up his own highly innovative system of counting cards. Kyle was eventually arrested in a casino and his parents

were shocked to find that he had an anonymous bank account overseas. At that point, his parents finally discovered a therapist who understood giftedness. The therapist helped Kyle deal with the intensity of his feelings, and both the upside and downside of feeling so different. Kyle still struggles to find friends but is at peace with himself and how he fits in the world. Despite his never attending college, several companies have tried to recruit Kyle because of his incredibly innovative mind, but he is content to make a decent living playing fantasy sports online. He still lives at home, attends an online university, and spends his days tinkering, programming, and watching YouTube videos and TED talks on a wide variety of technology topics. Kyle's story teaches us that gifted individuals can be autonomous and strong willed. They are unlikely to conform to societies expectations, and continued pressure to force them to conform, will not only prove futile but can result in emotional damage.

By eighth grade, high-achieving Elaine was suffering from severe anxiety caused by her perfectionism. Her parents and educators had no idea that she was wracked with insomnia and fears of never measuring up. Elaine often felt alone, isolated, and like fraud. Her physical and mental health suffered. Formerly a leader in her schools gifted program, she began to withdraw from academic challenge and adopted a persona that hid her intelligence from her classmates. At home however, she remained passionate about subjects well beyond her years. Her parents sought help from a local psychologist that specialized in gifted children. With this support, Elaine excelled in all her AP classes and standardized testing,

while managing her anxiety and perfectionism. She enrolled at an Ivy League university in another state, but without the continued support of her family and therapist, her old feelings and symptoms resurfaced, causing her to withdraw from school at the end of the first semester. Eventually, Elaine completed an undergraduate degree with honors in psychology and attend graduate school. She works helping other gifted individuals manage anxiety and emotional intensity. Elaine is the quintessential gifted girl, but like Kyle, was burdened by societies' confusion of giftedness being the same as high achievement. High achievement is not a measure of intelligence nor is it a measure of emotional well-being.

Forty-two years ago, the Department of Education commissioned the first report to Congress on Gifted Children, the Marland Report, which noted:

"Gifted Children can suffer psychological damage and permanent impairment of their abilities to function well which is equal to or greater than the similar deprivation suffered by any other population with special needs served by the Office of Education."

In spite of this report and many other studies implicating the psychological and physiological impact of giftedness, the majority of the medical and psychological communities are not aware of how intellectual giftedness impacts a person's overall health and well-being. GRO believes that much of this is due to the fact that America continues to limit the concept of giftedness to achievement in education. Until giftedness is recognized and understood as the whole person experience it is, the medical and psychological communities will continue to mistakenly misdiagnose and mis-medicate these individuals.

GRO is committed to studying giftedness from a multi-disciplinary perspective to better understand the physiological and psychological differences in gifted individuals and how these differences affect all facets of their lives. By contributing to the growing body of knowledge on human neurodiversity, GRO's integrative whole body approach will provide an understanding of the broad range of human physiology as well as the depths of the human mind. Though much study has been devoted to understanding individuals possessing developmental delays, far less research has been done on the physiological and psychological impact of giftedness. GRO believes that without understanding the outliers on both sides of the bell curve of intelligence, the full range of neurodiversity cannot be understood.

Conclusion

In an era where society rushes to "fix" every response and behavior that does not fall within a narrow range of "normal," we are doing a grave disservice to all populations outside the norm. The movement of neurodiversity is providing insight and understanding of outlier populations. It is imperative and long overdue for us to understand the differences in physiology of the outlier population known as gifted. GRO believes this understanding is necessary so that we do not continue to pathologize behavior attributable to giftedness and mistakenly prescribe treatments that could undermine the physical and psychological development essential to a gifted individual's ability to live a complete and meaningful life.

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