

Neural Plasticity in Adolescents and the positive effects of Tae Kwon Do

Introduction:

During the transition from childhood to adulthood the body goes through significant change, not least in the brain. The brain reaches maximum volume around the age of 9 with the makeup of white and grey matter being approximately 35% / 65% respectively¹. Grey matter is your neurons and white matter is your synapses. Joining neurons via synapses in various patterns gives the brain its ability to think and remember. At a young age we develop lots of linkages via our synapses as we experience life in our early years. This results in oversubscription of synaptic connections resulting in a higher proportion of white brain matter. During adolescence we go through an intense period of brain reorganisation and optimisation, commonly called synaptic pruning. At this point our brain is in a state of neural plasticity. Neural plasticity and synaptic pruning happens throughout our life as the brain adjusts to its environment and overall brain volume decreases with age, but this reorganisation is never so intense as it is during adolescence. As we exit adolescence the brain's proportions of grey and white matter has changed with more grey matter, neurons, having less but stronger synaptic links, the white matter.

When a child is born, their brain is not fully-formed, and over the first few years there's a great proliferation of connections between cells. Over adolescence there is a pruning back of these connections. The brain decides which connections are important to keep, and which can be let go. Synaptic pruning is thought to help the brain transition from childhood, when it is able to learn and make new connections easily, to adulthood, when it is a bit more settled in its structure but can focus on a single problem for longer and carry out more complex thought processes.²

The classic "use it or lose it" principle applies to adolescence—those circuits that are actively engaged may remain, those underutilized may be subject to systematic destruction. And so, for an adolescent, this means that if you want to learn a foreign language well, play a musical instrument, or be proficient at a sport, engaging in those activities before and during adolescence would be a good idea. We move from open potential in childhood to specialization during and following adolescence.³

This essay primarily looks at the age-related opportunity for students practicing Tae Kwon Do in the period of adolescence with some observations of the benefits of training in the more formative period of late childhood.

¹ American Journal of Neuroradiology - Age-Related Total Gray Matter and White Matter Changes in Normal Adult Brain. Part I: Volumetric MR Imaging Analysis

² <https://www.livescience.com/3435-teen-brains-clear-childhood-thoughts.html>

³ <https://www.psychologytoday.com/blog/inspire-rewire/201402/pruning-myelination-and-the-remodeling-adolescent-brain>

The Adolescent Brain

For teenagers the period of change in brain development during adolescence is an opportunity to strengthen positive neural pathways. The stimuli a child receives as they transition through adolescence will materially affect the adult they become. The stimuli can be positive or negative, or even absent, thus producing the corresponding development during adolescence. This is the point where Tae Kwon Do can be a significant positive influence.

As any parent has experienced adolescence is a time of joy seeing your child develop and angst as they test out their environment (and parents). This is a time when the child needs to develop independence in thought and action. They are experiencing a common animal need to test their limits and learn from their mistakes, so they are better prepared for life away from the protection of their family. They are also developing a need to procreate and start their own family to ensure the success of the species.

So, adolescents experience many hormonal, physical, psychological and neurological changes. This development manifests itself into two competing needs, independence and belonging. As said by Quentin Crisp⁴ “the thing about teenagers is they have the same problem, how to rebel and conform at the same time, they manage this by defying their parents and copying each other”.

Another factor to consider during adolescent brain development are the changes to the pre-frontal cortex. This is the seat of reasoning⁵ for adults, but with adolescents the pre-frontal cortex is not yet fully developed, it is fact the last part of the brain to fully develop. What this means is that an adolescent is more likely to take risks while not fully understanding risk. The combination of adolescents taking inappropriate risk, whilst ignoring good advice and trying to impress peers so they can be part of a tribe results in less than optimal decision making.

Adolescence is a time of experimentation and discovery, independence and belonging. As a parent of a teenager I try to offer my advice and wisdom, but it is often taken as telling my teenager what to do, suggesting how to think, this does not go down well. The fundamental issue is that I am the family they are trying to be independent of. At this stage of their development they need another advisor, someone they trust that is not their parent but that can offer good advice to help guide them in making better decisions.

UNICEF’s 2017 report on “The Adolescent Brain: A Second Window Of Opportunity” points out that an adolescent’s “*need for independence is not only emotional. Adolescence is a critical developmental phase of life, a time during which children acquire the social skills they need to thrive as adults. Just as critically, it is also the time in which their brains develop – or fail to develop – in a way that enables them to reach their full potential in life.*”⁶

⁴ BBC Radio - Infinite Monkey Cage Monday 29 January 2018

⁵ Nigel Latta – The Politically Incorrect Guide to Teenagers

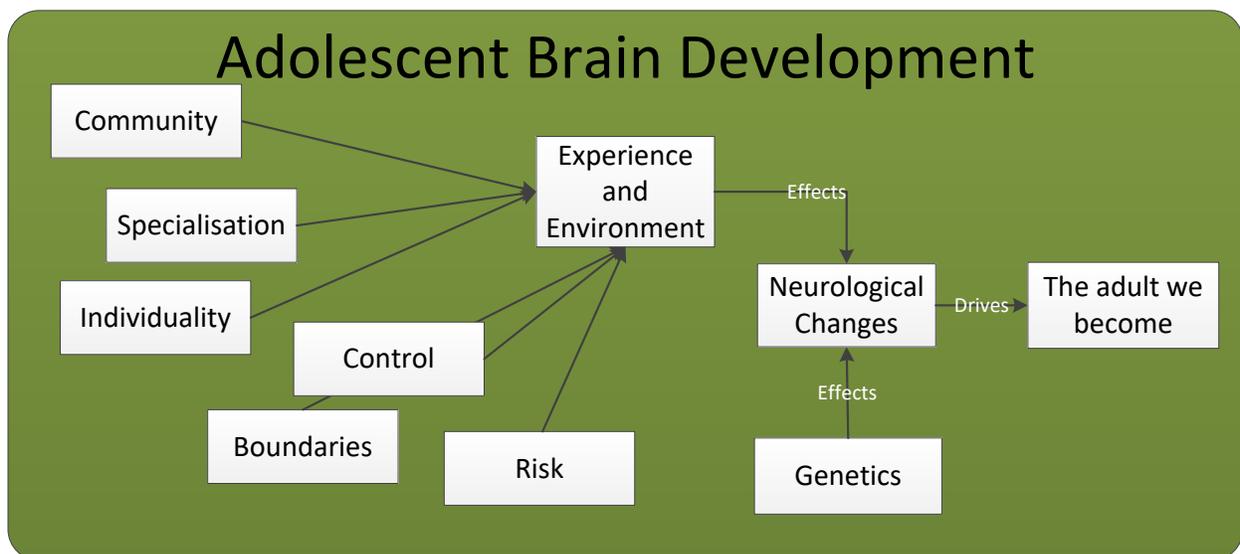
⁶ <https://www.unicef-irc.org/article/1750-the-adolescent-brain-a-second-window-of-opportunity.html>

It is well established that there are positive opportunities available to establish healthy patterns of behaviour in children. Recent research such as that collated by UNICEF⁶ indicate we have similar and, in some cases, better opportunities with adolescents.

UNICEF⁶ refers to childhood brain development as the first window of opportunity, a time to influence the development of children's brains through nutrition, stimulation and protection from violence and other harms. As well as inherent genetics UNICEF highlight that the second crucially important window of opportunity to influence the development of the brain also includes experiences the adolescent has and the environments they operate in.

The experience and environment factors that are pertinent to an adolescent's drive for experimentation, discovery, independence and belonging can be grouped into the areas of:

- Community
- Specialisation
- Individuality
- Boundaries and Control
- Risk



In the following section I will summarise the benefits of Tae Kwon Do in the first window of opportunity then analyse in more detail the second window of opportunity with reference the experience and environment areas listed above.

Benefits of Tae Kwon Do:

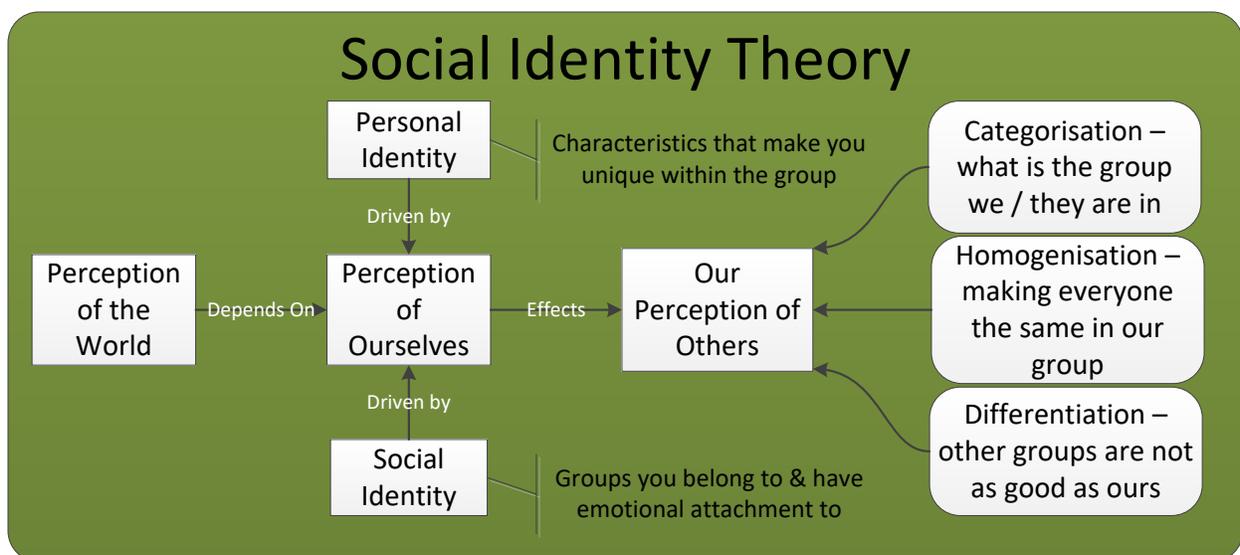
During the First Window of opportunity training in Tae Kwon Do for children gives us the opportunity to more securely embed our techniques as the neurological receptiveness of the child student to take in new learning is at its peak. The basic Tae Kwon Do techniques can thus form a stable foundation for more advanced techniques to build on. At these early ages students have the flexibility to adapt to, and embed complexity, thus the potential for greater proficiency at a later stage in training is greater. The trade-off for this flexibility and capacity is that an adult student has more defined cognitive reasoning capability to understand the purpose and application of the technique than a younger student.

During the Second Window of opportunity Tae Kwon Do offers positive experiences and a safe and supportive environment for the developing adolescent brain. Patterns of experience in early adolescence can have many long-term effects on social, emotional, and motivational tendencies that extend across the life span.

Community

From a community perspective a useful tool is the Social Identity theory that was originally formulated by Henri Tajfel and John Turner in the 1970s and the 1980s. It is a model that explains what drives our self-perception and how we fit ourselves into communities. As I have highlighted, an adolescent's perception of themselves is in a state of change and so is their perception of others, this affects the way they associate with some groups and not with others.

The diagram below describes the components of the model and how they interact with each other in establishing our self-perception and the perception of others.



In the areas that drive self-perception Tae Kwon Do provides an adolescent:

- A positive perception of the world, epitomised by our Tenets
- A strong sense of social identity by belonging to their club, the national iTKD body and the greater TKD community
- An opportunity to express personal identity and uniqueness via their individual technical achievements

Thus, the student develops a strong and healthy perception of themselves which flows through to a healthy perception of others, resulting in a well-balanced individual. These healthy learning experiences provided by the student's Tae Kwon Do community, such as the students club, steers the adolescent away from negative risk-taking activities towards positive exploration and learning.

The Tae Kwon Do community provides the belonging the brain requires at this stage of its development, a new tribe to be part of that is not the family unit. The benefits being part of a greater positive environment are met without compromising their need for individuality.

Specialisation

Adolescent neural plasticity gives us an opportunity for specialised learning in a discipline such as Tae Kwon Do that is not available in later life. It is a period when patterns of experience are shaping patterns of neural connections in the developing brain in a way that offers high levels of embedded neurological maturity and thus longevity. What you learn during this period in your life sticks. A competent adolescent student is more likely to recall and execute good Tae Kwon Do techniques throughout their Tae Kwon Do career.

Another transition is that of societal expectations of adolescents, which tend to change during this period, with the adolescent enjoying more respect, but also having more responsibility. Tae Kwon Do reflects this need for respect via the grading process and increased neurological specialisation as more advanced Tae Kwon Do techniques are imbedded. A student takes on more responsibility as their rank increases and they are afforded the appropriate respect in return.

Individuality

Tae Kwon Do allows the adolescent to be an individual as they become proficient with their techniques, they are the master of their own destiny and experience the level of individual control that their brain requires at this stage of its development. They are also in a supportive learning environment where they can test their limits in safe way. They have their instructor and seniors guiding them and their peers to work with. They also part of a community of likeminded individuals with strong ethical and moral beliefs thus making it easier to make better life decisions.

At the individual level, the adolescent student is transitioning physiologically, with structural remodelling and neuronal reconfiguring of the brain, resulting in increased ability for adult-level reasoning. The structured environment inside the Dojang offers a supportive environment where this transition is guided along positive paths.

Boundaries and Control

When the adolescent student enters the dojang they are governed by rules (as are all students). Some adolescents will not accept this and those are ones that are not suited to Tae Kwon Do. My observations are that most early adolescents are receptive to an Instructor led environment and will grow and adapt with their need for independence and belonging being met in a positive way. Some students who have not fitted in well are those that have generally been at the peak of their rebellion phase where any form of authority is seen as counter to their objectives. Where adolescent students accept the structured environment within the Dojang the Instructor can become a trusted advisor, someone who offers an acceptable level of discipline and boundaries that allow the adolescent student the right balance of independence and belonging. The Instructor is not a member of the student's direct family but is part of the larger family and thus is able to offer advice that the adolescent student can accept without compromising their need for independence.

Risk

It's ok to make mistakes in Tae Kwon Do and this is seen as a positive method of development. Making mistakes means taking acceptable and calculated risks. Adolescents want to take risks so allowing this in a controlled environment, under supervision, gives an adolescent the confidence to try new things and learn in the process. They learn how to assess risk and mitigate it in the appropriate way, a life skill they can then apply to other areas of their life.

Destruction is a good example of risk management where breaking a board is broken down into the constituent parts. A student understands the purpose of the attacking tool, the vital spots that are appropriate for the specific attack, the attack's direction and orientation, the attack surface and conditioning of the tool, and the mental discipline to execute the break. This is all taught before attempting the break thus risk is mitigated to an acceptable level. The student thus understands the residual risk when attempting the break and knows that they have taken the necessary steps to maximise the opportunity for success.

Conclusion:

During the times of intense neurological change in adolescence Tae Kwon Do not only provides a healthy physical environment but can also offer support in the areas of individuality and belonging, thus meeting the brains state change needs from childhood to adulthood. It provides a healthy supportive environment where adolescents can have a foundation to build positive brain development as they undergo a period of change that can be hard to manage and prone to mistakes.

As these physical, sexual and cerebral changes transpire, the adolescent student is at the same time finding her or his place in social hierarchies; a process accompanied by enhanced emotions of wanting to belong, be accepted and admired by peers and to be an individual. Tae Kwon Do delivers in all areas, a safe, trusted, facilitated environment that allows our students to grow.

Tae Kwon Do provides a healthy environment of positive experiences that breed resilience and tenacity in later life by imbedding the synaptic connections to become the adults we want our children to be.

Simon Lloyd-Evans
Tae Kwon Do - II Dan Black Belt
Instructor Spirit Kelburn