

## Impulses, Parents, MRIs, and Language with Dr. Tim Brown Show Notes

For Brainstorms' last episode before the holidays, I had the pleasure of talking to Dr. Tim Brown, neuroscience professor and clinician at UC San Diego. He primarily studies child development, and his research has been published in several academic journals. Dr. Brown also acts as the faculty advisor to a student group at UCSD called Interaxon, which teaches neuroscience to children and teenagers in the San Diego Area. Dr. Brown is an expert in many areas of pediatric neuroscience and psychology, and our discussion spanned impulse control, parenting styles, the future role of brain scanning in personalized medicine, and the way that language comprehension evolves from childhood to adulthood. So, without further ado, here is my conversation with Dr. Tim Brown of UC San Diego.

### Highlights of our conversation:

- Impulse control- the ability to stop ourselves before or during a negative behavior- is controlled by a region in the right side of the prefrontal cortex (called the inferior frontal gyrus). Impulse control improves gradually from childhood into adulthood- 10 year olds are better at it than 5 years olds, and 15 year olds are better than 10 year olds. The reason why teenagers are often targeted as having impulse control problems isn't because we are the worst at controlling ourselves- toddlers are much worse- but because the kinds of negative behaviors we do (smoking, doing drugs, etc.) are more dangerous.
- For adolescents, our spike in emotional activity makes impulse control especially difficult. We are more easily swayed by our emotions than adults. We also perceive reward more strongly than adults because we release more dopamine, the pleasure chemical. Teenagers are particularly prone to problems with overeating because we may use food (a pleasurable stimulus) to deal with emotions that go unchecked by our prefrontal cortex.
- As we get older, our prefrontal cortex becomes more developed. Becoming an adult is largely about gaining the skills associated with the prefrontal cortex. This includes impulse control and also the ability to think about rewards in the long-term. As we grow from children into adults, we become more aware of long-term goal setting and achievements that take time.
- Evolutionarily, lower impulse-control isn't totally a bad thing. Taking more risks allows us to experiment with our minds and bodies, and to make the mistakes that will instruct our behavior as adults. It's important for teenagers to take some risks and test the limits of their mental and physical selves. Unfortunately, though, some mistakes (getting addicted to cocaine, for instance) can ruin an adolescent's life.
- In the impulse control equation, parents play a critical but difficult role. Parents must help their children to control impulses while also letting them have the autonomy to make some mistakes and learn about life. Many teenagers and adults (Dr. Brown included)

recall times when they could “hear their parents’ voice in their head” as they were about to make a bad decision; for many of us, our parents’ opinions act as a sort of conscience that guides our behavior. For example, if someone offered you a cigarette, your immediate reaction may well be “What would Mom think if she smelled the smoke on my clothes?”. Parents can act as a surrogate, so to speak, for their teenager’s prefrontal cortex. However, parents must also be careful to let their adolescents develop boundaries and impulse control on their own. Adolescents must experience the world and proper decision-making so that they can become successful adults.

- Impulse control is the single most important skill in determining a person’s academic success and life satisfaction. Controlling for income and academic performance in middle school, teenagers with higher impulse control abilities report higher education levels, better jobs, and higher life satisfaction in young adulthood than those with poor impulse control.
- How can we improve our impulse control as teenagers? It turns out that adolescents can practice impulse control on their own time, even in relatively boring and harmless situations. Impulse control is all about learning to delay or deny certain feelings that are maladaptive. Dr. Brown suggests that a teenager might practice impulse control when they feel hungry for candy; instead of eating candy now, they can wait for a few days or a week before indulging the craving. This builds neural pathways for impulse control and also for long-term planning and achievement, two key factors in development.
- Scientists can see impulse control skills in the brain using functional magnetic resonance imaging (fMRI). fMRI measures the amount of blood flow to certain areas of the brain and takes a large number of pictures, giving us data about the brain’s activity over a course of seconds. On average, people with better impulse control show more activation in the inferior frontal gyrus (a part of the prefrontal cortex). However, it is important to note that fMRI *cannot make conclusions about individuals*. We can study trends, but the variance between people is so great that one brain scan doesn’t tell us much about a single person. For example, two people could report feeling the same amount of emotion when watching a movie, but one person’s amygdala, which responds to emotion, might light up much more than the other person’s amygdala.
- In terms of language processing, Dr. Brown studies a field called *lexical semantics*, or the meaning of single words as they are interpreted in the brain. If you ask a six-year-old what word comes to mind when you say “table,” they are likely to say “eat.” However, if you ask a 15 or 16-year-old, they will most likely say “chair” (this was my reaction). This is because, as we age, we start to categorize words and process them more abstractly. Children process words in the brain in an area near the visual cortex, which is at the back of the brain. This means children strongly associate words with mental pictures of their meaning. Teenagers and adults, on the other hand, associate words with

their category, their abstract meaning, and their function rather than their visual representation.

- Dr. Brown is especially curious to see how we can use fMRI to help individuals understand their own brains. Dr. Brown often works with children who have learning disorders, and he envisions that someday we might have a brain imaging battery that allows us to see if a child might have difficulties with reading or social skills before they even learn to read. This will give us the ability to enroll those students in special classes or get them the help they need before the problem can ever cause academic or emotional distress.

Thank you so much for listening to Brainstorms. After today, Brainstorms is going on holiday break, and will return with new episodes in mid-January. Thank you so much for listening, and please feel free to browse all of our episodes, reading lists, and online resources while Brainstorms breaks for the holiday!