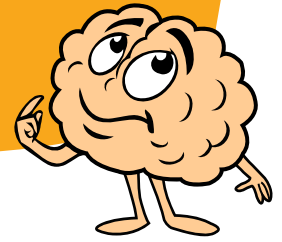


HOW IS PROBLEM GAMBLING LIKE AN ADDICTION TO ALCOHOL OR DRUGS, FROM MY BRAIN'S POINT OF VIEW?



Imagine, for a moment, a car. The Reward Network in your brain is like the gas pedal in your car. It gives the 'GO!' signal to move towards something you want – there may even be a thrill as you press the gas. The Top-Down Control Network, on the other hand, is the brake pedal in your car. It gives the 'STOP!' signal that tells you to stop what you are doing. Some researchers describe addiction as being a problem with both the Reward and Top-Down Control Networks (your gas pedal and brakes).

Studies show that both people with gambling problems and people with substance use problems have inconsistent 'pedals' and 'brakes'. To understand what is happening in the brain, we must look more carefully at these two networks:

THE REWARD HUB – 'GO!'



The Reward Network is made up of different brain regions that talk to each other. The **Ventral Striatum**, also known as the '**Reward Hub**' (see *Figure 1*), is an important part of this network. The Reward Hub's job is to help us gauge when a reward might come our way. It recognizes the cues that predict a reward. Normally, the Reward Hub 'lights up' (activates) when it anticipates a reward (for example, the smell from the kitchen when your favourite meal is cooking, your dog or cat coming to the door to greet you at the end of the day or getting dressed up for a social activity you have been looking forward to). However, recent analysis of brain imaging studies comparing people with substance addictions and people with gambling problems (see *Figure 2*) shows that both groups have less activity in the Reward Hub, compared to people without addictions when it comes to anticipating rewards¹.

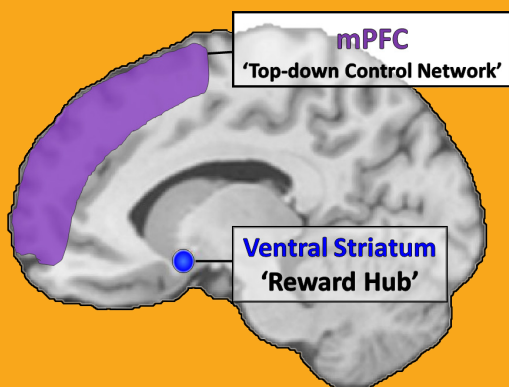
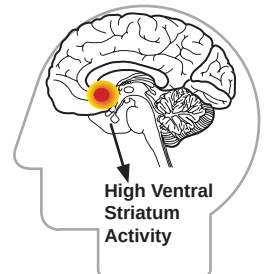
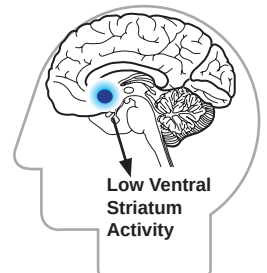


Figure 1

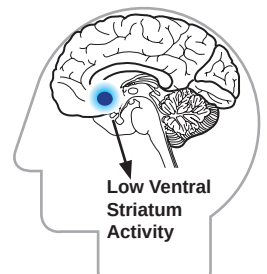
What this means is that people with addictions don't process rewards in the same way. They may not be as excited by natural rewards. They might also have trouble learning how new experiences, such as taking up a hobby for the first time, could be enjoyable. That is why some people might seek out unnatural rewards (like gambling, alcohol or drugs) just to feel pleasure or to escape. But doing this can push the 'GO!' pedal to the extreme and may override the brake system.



Person with No Addiction: High Reward Hub Activity When Anticipating Reward



Person with Problem Gambling: Low Reward Hub Activity When Anticipating Reward



Person with Substance Use Disorder: Low Reward Hub Activity When Anticipating Reward

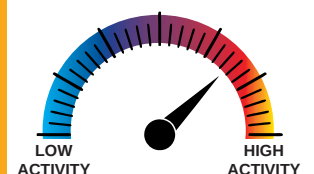


Figure 2

¹ Luijten et al., (2017). *JAMA Psychiatry*, 74(4), 387-398.



THE TOP-DOWN CONTROL NETWORK – ‘STOP!’

The Top-down Control Network acts as the ‘brakes’ to the Reward Network. Brain areas like the **medial Prefrontal Cortex (mPFC)** (see *Figure 1*), also known as the ‘**Top-down Control Network**’, are involved in paying attention and stopping a response – this is called ‘inhibition’.

As you can imagine, brakes that work well would be very important when we are pushing the gas pedal to the extreme, as happens in problem gambling. The research tells us that the brakes amongst problem gamblers do not work very well. In one study², for instance, researchers scanned the brains of individuals who are told to press a button as quickly as possible when they see a ‘GO!’ signal (e.g. a green light) and then see what happens in the brain when they get a ‘STOP!’ signal (i.e., how quickly can they stop themselves from hitting the ‘Go’ button when they see a red light?). These studies show brain differences in people who have an addiction when they get a ‘STOP!’ signal.



Specifically, this study compared three groups²: (1) individuals with problem gambling, (2) heavy smokers and (3) individuals with no addictions at all. The researchers discovered two things about the individuals with either a gambling or smoking addiction (see *Figure 3*). First, they show less activity in the Top-Down Control Network during a ‘STOP!’ signal. Second, their brakes don’t work very well – they pay less attention to the ‘STOP!’ signal and are less able to ‘put on the brakes’. In addition, the researchers also noticed that the more severe the gambling problem, the less activity is seen in the Top-Down Control Network. So, the more addicted you are to gambling, the less well your ‘brakes’ will work and the more problems you could have engaging your Top-down Control Network when gambling. This means that once you start gambling, it can be hard to stop (but not impossible!).

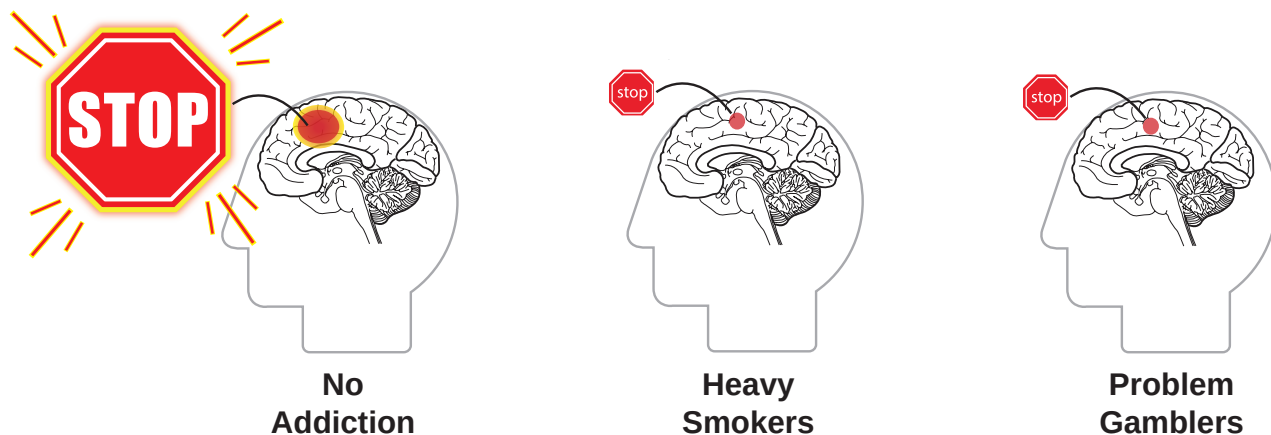


Figure 3 USING YOUR mPFC TO STOP SUCCESSFULLY: When given a stop signal, heavy smokers and problem gamblers show less activity in the Top-down Control Network.

ACTIVITY: 'REWARD HUB' OR 'TOP-DOWN CONTROL NETWORK'?

Which part of the brain do you think is responsible for each statement below?

1. I said 'no' to a gambling urge. _____
2. I'm imagining how I will spend my gambling winnings. _____
3. I really want to gamble right now – I think I'll just take \$20. _____
4. I want to gamble but I know that's a bad decision so I won't go. _____

1. TOP-DOWN CONTROL NETWORK; 2. REWARD HUB; 3. REWARD HUB; 4. TOP-DOWN CONTROL NETWORK

GOING FURTHER:

How do you think your 'pedal' and 'brakes' have been affected by addiction? For example, do you find it harder to say 'no' to things that you know are not good for you? Do you have difficulties with boredom? Do you feel like nothing will ever be pleasurable for you again? What natural rewards or new experiences could you try in the next few days?

TAKE HOME MESSAGE: When anticipating rewards, the 'GO!' network can show less activity in people with addictions. This means that they might seek out unnatural rewards to activate the 'GO!' network and push the gas pedal to the extreme. This is why people with an addiction may not be as excited by natural rewards and they might also have trouble learning how new experiences could be enjoyable. In addition, people might not notice the need to stop an addictive behaviour and, even if they do, their 'brakes' may not work as well. Nonetheless, the 'GO!' and 'STOP!' networks can change how they respond to natural rewards. **The good news is that the brain is always changing. Keep rewarding yourself with natural, healthy activities in moderation. Repeat these activities because it will take time for your brain to find pleasure again. Avoid unnatural rewards that could wear out your pedal and brakes.**

