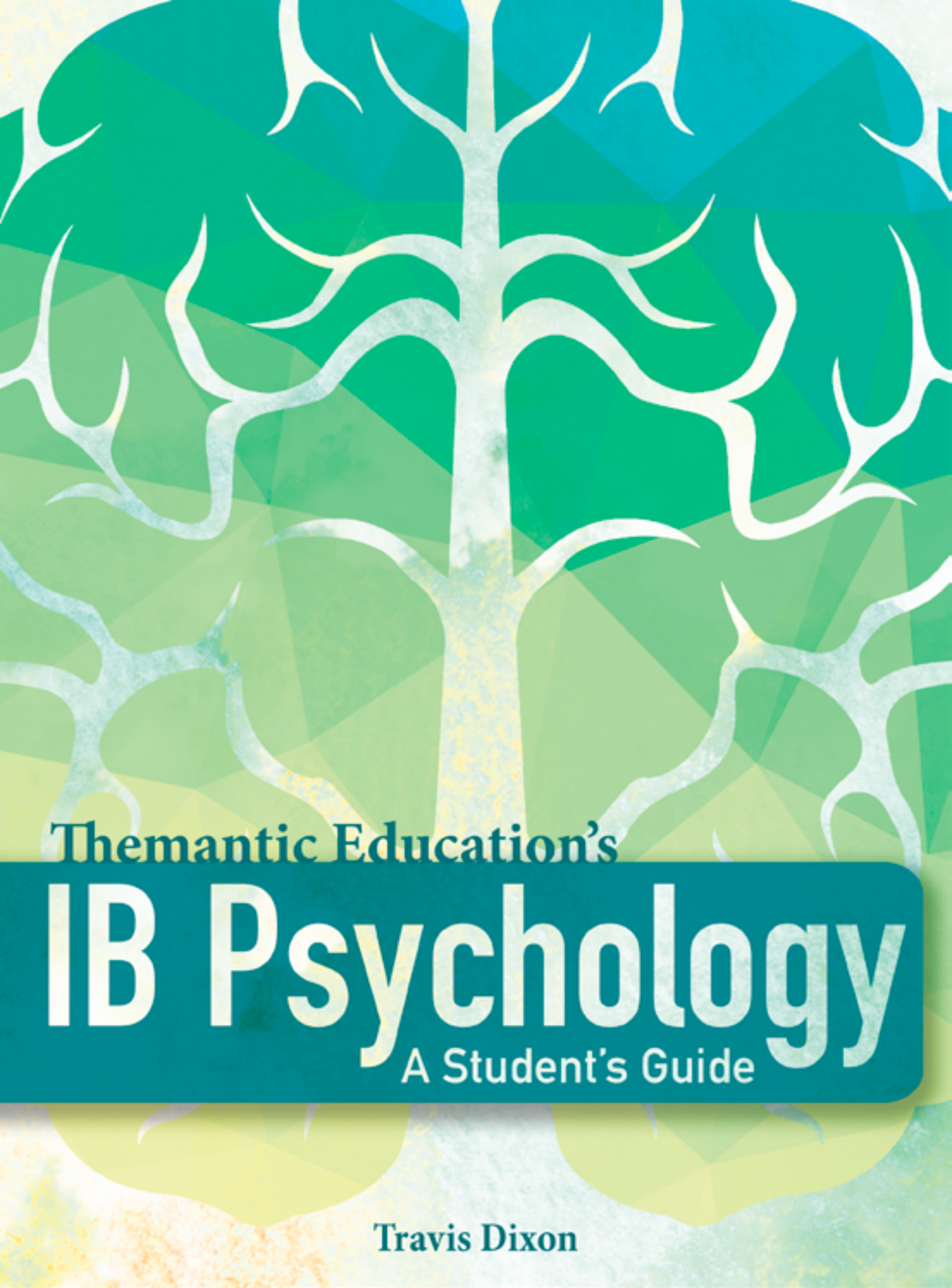
Themantic Education's
IB Psychology
A Student's Guide
Travis Dixon

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Disclaimer: please note there may be minor amendments to the final product

Introduction

In the middle of the night on August 1st, 1966, 26-year-old Charles Whitman sat down at his typewriter in his house and began typing a letter.

It begins:

"…I don't really understand myself these days. I am supposed to be an average reasonable and intelligent young man. However, lately (I don't recall when it started) I have been a victim of very unusual and irrational thoughts." Later that night, Whitman drove to his mother's house and killed her. Before leaving, he wrote a note and left it next to her on the bed:

"TO WHOM IT MAY CONCERN,

I've just taken my mother's life. I am very upset over having done it. However I feel that if there is a heaven she is definitely there now…"

Later that night Whitman murdered his young wife, Kathy, while she lay sleeping in bed. He stabbed her numerous times in the chest. Before he did this he wrote another letter…"…It was after much thought that I decided to kill my wife, Kathy, tonight after I pick her up from work at the telephone company. I love her dearly, and she has been as fine a wife to me as any man could ever hope to have. I cannot rationally pinpoint any specific reason for doing this." (Austin History Centre)

Later that day Whitman drove to the University of Texas at Austin campus, where he was a student. He had packed a huge case filled with guns, ammunition, food, water and enough supplies to last for a few days. He climbed to the top of the observation tower that looks out over the campus and the city. Whitman killed the receptionist with the butt of a rifle. He then set up his sniper rifle on the tower and began taking aim at innocent people as they walked around the campus.

In two hours of what must have been horrific terror for the people of Austin, Whitman killed 14 people, and injured over 30 others.

What are your thoughts when you hear the story of Charles Whitman?

Whitman's case was and still is a mystery, like many murderers and serial killers who seem to kill without reason. But your job as a psychologist isn't necessarily to judge people's behaviour, it's to investigate the research in order to understand it. In this chapter you are going to be introduced to the fascinating subject of psychology by looking at criminal behaviour.

Charles Whitman. (Image from wikimedia commons)

In understanding how and why people behave and think the way they do, we have to consider multiple factors – including biological, environmental, cultural and social influences. By the end of this chapter, you're going to be challenged to answer this question: How might a variation of the MAOA gene increase the likelihood of someone reacting aggressively in a socially threatening situation?

If you can keep up with the guiding questions and you understand the significant relationships explained in each section, by the time you reach the topic of genetics you will hopefully be able to answer this really difficult question. In doing so you'll realise that understanding human behaviour is rarely simple.

2.1 The Brain and Behaviour

How might brain damage affect our behaviour?

(a) The Frontal Lobe

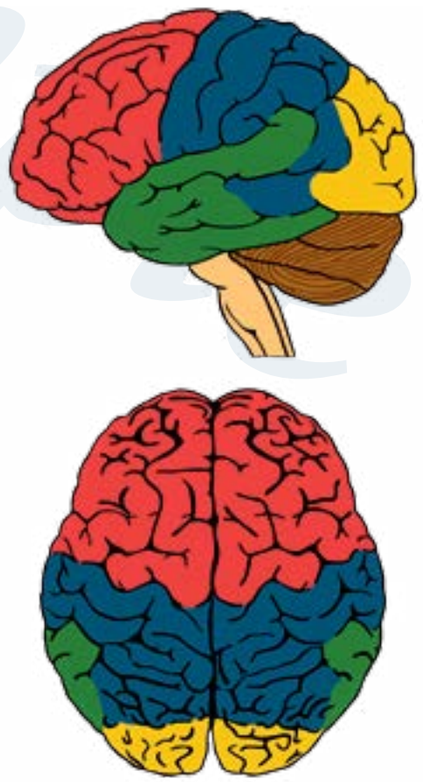
In this first introduction to understanding violent crime, we're going to focus on the most important organ in our bodies – the brain. As you'll remember from the introduction, it's always important that you analyze the evidence when making conclusions about behaviour. Remember that understanding human behaviour and mental processes is about understanding relationships, and research (studies and theories) can demonstrate those relationships.

Numerous studies have shown that there are correlations found between brain function and violent behaviour. Moreover, there are specific parts of the brain that appear to be different in some violent criminals than in non-violent, ordinary people. In order to fully understand these concepts, it's important to have a general understanding of some of the functions of important parts of the brain first.

Localization of Brain Function:
This describes the concept of different parts of the brain having different functions.

When discussing the brain in psychology, researchers refer to specific areas of the brain. Different areas of the brain perform different functions, a concept known as localization of brain function.

The brain is generally divided into different lobes, as shown in the image. To begin with, we're going to begin our focus on what I think is one of the most interesting parts of the brain – the frontal lobe.



Our brain is made up of different lobes. For now we are going to focus on the frontal lobe (in red) and later in this chapter you will learn about the temporal lobe (in green).

One important function of the frontal lobe is to regulate our impulsive behaviour and decision making. When the frontal lobe is functioning normally it kind of acts like a "break" on our impulsive behaviour. So when you get really angry at your teacher/parent/friend and you want to yell and scream at them but don't because you know that it might get you in trouble - you have your frontal lobe to thank. Or if you're walking down the street and you see an attractive person and you think, "Wow! They're gorgeous!" and you keep that thought to yourself – once again, you have your trusted frontal lobe to thank. Teenagers' frontal lobes are still developing and are not fully formed until later in adult life, which might explain why teenagers can be more impulsive and more likely to take risks than boring adults.

But how do we know about the functions of the frontal lobe? Well, how do we "know" anything in psychology? We always have to consult the research. And there is a lot of research on the frontal lobe.

One of the most famous studies of a man who had severe damage to his frontal lobe was that of Phineas Gage. I'm going to tell you Gage's story because it's really interesting and I'll guarantee you that you remember this story for a long time, probably because of its gory details. But I will also say that it's best if you forget about him come exam day. We're going to investigate far better evidence regarding the functions of the brain, and the frontal lobe. I introduce Gage here because it's a fascinating story, but also because it generally marks the beginning of studies into understanding neuropsychology.

Neuropsychology:
The study of the complex relationships between the brain and behaviour.

Gage was a railroad worker who was putting dynamite into rocks while working with a team to lay train tracks. As he used a six-foot bar to pound the dynamite powder into the rocks it ignited, essentially making the long steel pole a bullet that fired up through his left eye socket, through the top of his skull and landed about 50ft away. Gage survived and was even conscious while he rode on the cart to the nearest town to get help. He went to see the Doctor and probably said something like, "can you help me with this?"

Phineas Gage posing with the steel rod that shot through his frontal lobe.

As a result of the incident, Gage's behaviour seemed to change as he went from being a rather mild-mannered man to "no longer Gage" as his friends said. Reports have even said that he was no longer allowed to be around women because he would often say rude things to them. This was in 1848 and Harlow, the Doctor who treated Gage, made a few observations about the change in Gage's behaviour that has made him one of the first and most famous cases that links brain damage to our personality, our "sense of self' and also to our ability to regulate (control) our behaviour (Smithsonian Magazine). It is this final function that we're going to explore further.

Guiding Question:

How does Phineas Gage's case suggest that damage to the frontal lobe affects impulsive behaviour?

Abstraction Extension:
Causation v Correlation: Many students make the mistake of jumping to conclusions like, "Phineas Gage's study proves that damage to the frontal lobe causes impulsive behaviour." In order to deduce causation we need to eliminate the possibility of other factors other than the brain damage affecting Gage's behaviour. What other alternative explanations could there be for the change in Gage's behaviour?

If you're interested…

You can find plenty of information about Phineas Gage online, including one article by the Smithsonian Museum's online magazine. The article is called "Phineas Gage: Neuroscience's Most Famous Patient." The neuroscientist Robert Sapolsky also explains the case of Gage in one of his Stanford lectures (available on YouTube) and he says jokingly, that they take your license away if you don't explain Phineas Gage in an introductory psychology class and I took his warning to heart.

(b) The Prefrontal Cortex and Aggression

Aggression:
Feelings of anger and hostility towards someone or something, often resulting in violent actions.

Since Gage there has been a lot more research into the functions of frontal lobe, especially the area within the frontal lobe called the prefrontal cortex (PFC). The prefrontal cortex is a more specific area within the frontal lobe. It's at the very front of the frontal lobe; it's the area of the brain just above the eyebrows beneath the forehead. The term lobe refers to the whole section of the brain, whereas cortex refers to the dense outer layer of the brain.

Like Gage's study first suggested, lots of recent research has shown that an important function of the prefrontal cortex is to regulate our impulsive decision making and our emotion. This has been shown partly through studies that show people with prefrontal cortex damage lack an ability to inhibit their impulsive behaviour, may not be able to behave in socially appropriate manners and may be easily provoked into aggression. Studies have also shown that there is a correlation between low functioning frontal lobes and criminal behaviour. (Clark et al, 2008; Blair, 2010)

Understanding the biology behind criminal behaviour is a popular and important field of study. British criminologist Adrian Raine has conducted many studies investigating biological correlates of criminal behaviour. He and some of his colleagues carried out a study in 1997 with the aim of comparing the brains of convicted murderers with those of healthy controls (i.e. people who had never been convicted of violent crime). The results showed that there was less activity in particular areas of the brains of the murderers, including less activity in the prefrontal cortex. (Raine, Buchsbaum & Lacasse, 1997)

Raine's studies, like many others, can show us that the brains of violent criminals are different to "normal" controls. But it only suggests a correlation and leaves a lot of uncertainty. Another way of studying how the brain can influence behaviour is to find people who have existing brain damage in particular areas of the brain and to compare them with control groups.

During the Vietnam War many soldiers received injuries to their brains from a variety of factors (e.g. bullets, explosions, land mines, etc.). The use of brain imaging technology (e.g. MRI – see section on brain imaging technology for more information) allows researchers to pinpoint the exact location of the damage and to find those participants who have damage in areas of specific interest, like the prefrontal cortex. The Vietnam Head Injury Study (VHIS) is a longitudinal study of over 1,000 American veterans of the Vietnam War that aims to research the impact brain injury has on behaviour. One such report from the VHIS came from investigating the connections between frontal lobe damage and the influence this damage had on the aggressive tendencies of the patients. (Grafman et al. 1996)

Based on prior research, the researchers hypothesized that the prefrontal cortex helps exert control over automatic reactions to environmental provocation. In other words, when something makes us emotional, our prefrontal cortex functions to help stop us from reacting in a violent or aggressive manner. To test this idea, the researchers compared Vietnam War veterans who had suffered brain injuries with healthy controls (people with no brain injury). The veterans were also divided into those who had injuries specifically in the prefrontal cortex, and those who had damage to other areas of the brain. MRI machines were used to locate the damage in their brains.

The researchers hypothesized that because of the role of the prefrontal cortex in inhibiting impulsive behaviours (e.g. reacting violently to someone who makes you angry) those veterans with damage in the prefrontal cortices would demonstrate more aggression than those with no damage or damage to other parts of their brain.

Many war veterans end up with brain injuries. The Vietnam Head Injury Study uses this naturally occurring variable to further our understanding of brain function.

The researchers gathered data on a range of aggressive and violent attitudes and behaviours of the participants using self-report forms (e.g. questionnaires) and family observations. This means they measured aggression by asking questions such as, "How often do you react with physical aggression when someone makes you angry?" (Never, Sometimes, Always, etc.) Or, "How often do you swear or shout at people who make you angry?" Etc.

The results showed that those veterans who had damage to their prefrontal cortex had higher levels of reported violence and aggression than the controls or veterans with damage to other parts of the brain. By using MRI technology and being able to compare the three groups in the study, the researchers were able to draw the conclusion that damage to the prefrontal cortex is more likely to lead to aggressive behaviours than no damage or damage to other areas of the brain.

This is an interesting finding and it's a good basic introduction to the study of the brain and behaviour. However, the issue with this study is that it doesn't tell us how damage to the prefrontal cortex might influence our behaviour: we'll get to that in the next section.

Guiding Question:

How does the Vietnam Head Injury study show that damage to the prefrontal cortex may affect aggression?

Abstraction Extension:
Evaluating Methodology: On the surface, it appears this study may show a relationship between prefrontal cortex damage and aggression. But you have to think critically about the methodology. They measured aggression and violence by using self-report forms, which are the participants' own answers to the questions. When evaluating research methods, we have to think about their effectiveness in investigating the specific relationship we're investigating. So in this study, to what extent are self-report of violence and aggression useful ways of gathering data? In studying aggression, would people always be honest?

If you're interested…

The magazine The New Yorker has an article called "Vietnam's Neuroscientific Legacy" that goes into more detail explaining this longitudinal study on Vietnam war veterans and the significance of its findings.

Relevant Topics	*Possible Exam Questions*
• Ethics (BA) • Research Methods (BA) • The Brain and Behaviour	• Evaluate one study related to the brain and behaviour. • Outline one method used to study the brain and behaviour. • Discuss research into the brain and behaviour. • Discuss ethical considerations related to studying the brain and behaviour.

Research Methods	*Ethical Considerations*
When studying naturally occurring variables such as brain damage, the natural experiment is immensely valuable to researchers. There's no way they could manipulate this variable on humans in a laboratory, so by finding samples like those in the VHIS who have these existing conditions can be extremely useful.	When studying sensitive subjects like aggression, anonymity is an important consideration. Individuals who display high levels of aggression, especially in family situations, would probably not want their level of aggressiveness made public. Informed consent is also important when investigating such sensitive issues and using tools like questionnaires: participants would want to know why the researchers were asking such personal questions before they participated. Not knowing this information beforehand could lead to stress, embarrassment or frustration.

2.2 Brain Damage and Cognition

How might brain damage affect the way we think?

(a) Judgement, Processing and Decision Making

Hopefully you have started to see how the research paints a pretty strong picture of the effect damage to the prefrontal cortex can have on our behaviour. But so far the evidence we've looked at can't really tell us exactly how the prefrontal cortex influences behaviour, only that it does. In order to know exactly how damage to the prefrontal cortex can influence aggression, we need to go deeper inside the brain.

But first, we need to move beyond just the brain, and look inside the mind!

Let's first look at an interesting experimental paradigm that involves a child, a marshmallow and a ten-minute wait with the prospect of two marshmallows. A paradigm is a pattern or typical example of something; in psychology there are many experimental paradigms which means a general design of a study that is often used. This experimental paradigm involves putting a child in a room and giving them one marshmallow. A researcher tells the child that they have to wait ten minutes and then if when the researcher comes back the marshmallow is still there, they'll be given a second marshmallow and they can eat both. Could you imagine the poor little kids having to resist this temptation? Some kids can, and others can't. (E.g. Mischel, Shoda, & Rodriguez, 1989; Mischel et al, 2011 ;).

These experiments with marshmallows are typically done on small children because if we tried it on teenagers, the prospect of having two marshmallows might not

If you were a young kid, do you think you'd be able to wait ten minutes for another marshmallow? Try to imagine what kinds of thoughts would be going through a child's head as they wrestle with this problem.

be that enticing. But would you have a hard time waiting to get something you really loved right now, if it meant by waiting you could get more of that awesome thing? We're going to see how the ability to control our initial impulse and to think more about the future is a key function of the prefrontal cortex. As you learn more about this fascinating part of the brain, perhaps you'll be able to hypothesize explanations for why studies have shown that those kids who can wait for two marshmallows are more likely to grow up to be successful in school.

First, let's try to understand the decision making process that might be happening in this scenario. There are many theories of how and why decisions are made, but here we're going to look at a pretty basic one that might help us understand human behaviour a little better. After all, we can't understand behavior (the way we act) without thinking about cognition (the way we think).

Deciding how to behave in a particular situation first involves processing the information available to you before making a judgement about that information and then making a decision. If we think about this in terms of the research we've just seen on the Vietnam vets, imagine the door bell ringing at dinner time. The family is around the table, everything's peaceful, and then "ding-dong"! Dad reacts by storming across the room and shouting down the hallway, "don't you know it's dinner time???!!!!" But Dad didn't do this without thinking – his brain didn't automatically just make him do it. He had to perform a series of mental processes that lead to his shouting and getting angry. First, he needed to process the information (the door bell ringing, the time of day), then make a judgment (no-one should be knocking at this time) and then make a decision (to shout at the person knocking).

Processing: Analysing and considering available information

▶

Judgement: Making an assessment based on the analysis of information

▶

Decision Making: Drawing a conclusion and deciding how to act based on the judgement made.

Here we see that to understand the behaviour (e.g. being angry) we have to also understand the thinking. The cognitive processes involved here are processing, judgment and decision making. While this seems like a basic concept, knowing how these three relate to one another is key to understanding the rather complex theory explained in the next section.

Guiding Question:

How might processing be influencing the judgement and decision making of the children in the marshmallow study?

Abstraction Extension:
One of the studies you will study later in this section about judgement and decision involves a gambling task. Think of a type of gambling that you are familiar with (e.g. betting on sports, horse races, playing poker, slot machines, etc.). Can you explain the relationship between processing, judgment and decision making involved in that particular type of gambling?

If you're interested…

There are some interesting TED talks about the marshmallow experiment that you can watch. One is called "The Marshmallow Test and Why We Want Instant Gratification" by Silvia Barcellos.

(b) A Dual Process Model of Decision Making

"Dual" means two, so in psychological theories, a dual theory means there are two factors involved. The following theory about how we make decisions is based on how we process the information available to us in order to make the decision. The less we process the faster we make a decision. Conversely, the more we process the longer it takes for us to make a decision.

So for Dad's example when the doorbell rings at dinner time, some Dad's might not process much at all and hear the bell (or knock) and ***snap!*** They get angry. Another Dad might hear the bell ring, become irritated, but then think "maybe that's Grandma coming to tell us how Grandad's operation was."

Various researchers have proposed dual process models to explain two types of processing involved when making a decision.

The dual process model is a general description of how we process information by using different systems when making decisions.

They are appropriately known as:
- System One Processing
- System Two Processing

When we process information using system one it's fast and automatic. It's also often based on emotion (Kahneman, 2003). In other words, when processing information using system one we make a decision without really thinking about it. So getting angry and snapping at the doorbell is processing information using system one. The information in this example is the doorbell ringing – processing involves thinking about that information.

System Two is "slower…effortful and deliberately controlled" (Kahneman). When processing information using system two, we take our time and consider more factors. So processing the doorbell ringing using system two requires a little more thought, taking into consideration more factors like "who might this be?"

Two Systems of Processing Involved in Thinking and Decision Making (Evans and Stanovic, 2013)

System One	*System Two*
• Fast • Nonconscious • Automatic • Based on experiences	• Slow • Conscious • Controlled • Based on consequences

Let's go back to the kids and the marshmallows. Some kids probably ate the marshmallow straight away as soon as the researcher left the room. But others struggled, they agonized, they fought the temptation. They were probably continually trying to think about the prospect of getting two marshmallows for their efforts. According to the dual processing model of decision making, they were processing using system two, again and again and again for ten whole minutes – thinking about those other factors like how great it will feel to have two marshmallows. Here we see the decision making isn't just applicable to one situation (aggression) we could apply this theory to many types of behaviours. In fact, findings from the Stanford Marshmallow Experiments have found that kids that can resist the temptation have a higher chance to grow up

to be successful in many ways, including higher SAT scores, lower stress and lower chances of becoming addicted to drugs. (Mischel et al, 2011)

Let's look at one more possible example of what this might look like: you're sitting in a test with 20 multiple choice questions and you really want to do well. You're at the front of the class and the supervising teacher has fallen asleep with the answers sitting in front of him. You need to pass the test in order to pass the class and you can simply sneak a peek and see the answers. Processing the information available using system one would involve not thinking past the "need to pass, see answers, get answers!" Using only this system might lead you to look at the answers and copy them into your test so you could pass the class. You've made this decision quickly and haven't thought too much about it. However, using system two processing might override this initial response as you think more carefully about the possible long-term consequences of your actions: "what if the teacher wakes up and I get caught?" "What if I pass but then I might feel guilty for the rest of my life?" "What if they're not even the actual answers?"

What the dual-process model allows us to do when explaining people's behaviour, is to hypothesize (based on the theory) how the person might have made the decision to act. You'll learn in later sections how damage to the brain might influence the ability to use system two processing.

Guiding Question:

How can the system used in processing influence judgment and decision making?

Abstraction Extension:
Evaluating Psychological Theories by challenging Assertions: when learning about new **theories** (e.g. Dual Process Model), it's always tempting for students to think of these as facts and to talk about them as facts because "I read it in the textbook so it must be true." It's true that the dual process model is ***one*** explanation of decision making, but it is not the only explanation. Try to see if you can come up with examples of decision making that can't be explained by this model. I.e. test the theory! This is one way of critically assessing psychological theories: examining to what extent they are accurate in explaining the **phenomenon** in question.

If you're interested…

The American Psychological Association (APA) has many interesting resources related to all fields of psychology. In particular, they have an article available called "Delaying Gratification" which goes into detail about the Stanford Marshmallow Experiments, including research using fMRIs to test the function of the prefrontal cortex when people are presented with something tempting.