

Themantic Education's

IB Psychology

A Student's Guide

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Introduction

Welcome to the wonderful world of psychology – *the scientific study of individual human behaviour and mental processes*. This is a fancy way of saying that psychology is the study of how and why people think and act the way they do. While you probably haven't studied psychology in school as a subject yet, you may already be familiar with some aspects of psychological study like amnesia, conformity, and psychiatric disorders. You may have come across these ideas as psychology is such an interesting and popular subject that it appears everywhere in the media, including in films, TV shows and in the news.

But because Psychology is not like other school subjects such as Biology, Maths or English, where you are familiar with what's involved in these courses and how to do well, it is important to take the time to learn a little about what this course is all about and how to succeed in IB Psychology *before* getting stuck into the heart of the course. This is the primary goal of this introductory chapter.

This book has been written and constructed to accompany the teaching and learning of the IB Psychology course. With this purpose in mind, it has been crafted in a way that is different to many other textbooks. For one, it's not written using language that is of a formal and academic style that is traditional for many textbooks. Instead, it's written in a conversational and informal tone, similar to how I would talk to my students in a classroom. As you're reading the explanations in this book, I hope they're like another voice helping to guide your study, support your teacher's explanations, and deepen your understanding of this intriguing subject.

You'll notice there are lots of anecdotal and everyday examples included throughout the book. These are designed to help you access the information and to build your knowledge. Sometimes it's tricky to think about psychological concepts in the abstract, so these examples help to make things a little more concrete. That being said, the *end goal* is that you will be able to understand the abstract concepts by themselves and explain them in a precise manner using correct terminology and with empirical evidence, not anecdotal evidence or examples.

We'll begin by breaking down the definition of psychology, the *scientific study of individual human behaviour and mental processes*, as this seems like a logical place to start. This thematic textbook is designed so that your learning builds over time and understanding one idea will deepen the next. The end result will hopefully be a deep understanding of important concepts and a desire to continue exploring this fascinating subject.

The IB Psychology course is immensely challenging, but if you are conscientious, ask questions, and work hard to develop your thinking skills, I'm sure you'll find it incredibly rewarding!

Psychology is the scientific study of behaviour and internal mental processes.

This textbook should always come second to your teacher's advice and guidance. Think of the book as a guide, but your teacher is the pilot.

1.1 Introduction to Psychology

What is “psychology”?

(a) Behaviour and Mental Processes

Let's ease into this course and begin your career as a psychologist by starting with a general introduction to what psychologists actually do. As mentioned in the introduction, psychology is the scientific study of individual behaviour and mental processes. A **behaviour** in a psychological sense is commonly defined as an action that can be observed. For instance, the way people go along with a group because of peer pressure is an example of a behaviour called **conformity**. Or when there is a person in need of help but everyone walks past and does nothing is another commonly observed human behaviour known as **bystanderism**. These are examples of behaviours because they're actions by humans that are *observable*.

Along with studying behaviour, psychologists also study **mental processes**. Other terms for mental processes include **cognitive processes**, **cognition**, **mental processes** or **internal processes**. These terms are used interchangeably and all mean the same thing. If we think about behaviour as being the way we *act*, cognition is the way we *think*.

Like many complex ideas, “behaviour” is rather difficult to define in a black-and-white sense and so it's important that you try to understand it conceptually. That is to say, think about real life examples and get an understanding of the idea instead of trying to memorise the definition. Moreover, just to make things tricky the IB Psychology course, considers mental processes as part of behaviour. For example, there are three approaches to understanding “behaviour” that form part of the core of the course: the biological, cognitive and sociocultural approaches. Cognition can be studied in these approaches to understanding “behaviour.” So for now as you get started, let's think of behaviour as an umbrella term that includes observable actions *and* cognitive processes.

Behaviour	
Observable Actions	Mental Processes (Cognition)
<ul style="list-style-type: none"> • Violence, aggression and violent crime • Conformity and compliance • Bystanderism • Attraction • Mate selection (choosing whom to marry and/or have children with) • Communication 	<ul style="list-style-type: none"> • Processing • Judgement • Thinking • Decision making • Memory • Perception • Problem-solving • Attention • Language

Some psychologists focus primarily on studying observable behaviours, while others specialize in investigating cognitive processes. In the IB Psychology course



Cognition refers to the internal working functions of the mind.

you'll develop an understanding of *both*, including how they interact and can influence one another.

Cognition can be an abstract concept and like many abstract concepts you'll be introduced to, a good way to understand it is to make connections with what you already know. Try reflecting on your own cognitive processes. For example, how do you get from your house to school each morning? Picture yourself at the front door and then in your mind imagine the way you have to get to school. You will be able to see a lot of things in your mind, including the streets and buildings along the way. This is using your memory, which is a

really important cognitive process. More specifically it's using visual-spatial memory, which is your ability to remember what things look like, a very helpful skill when you are trying to find your way around. Or use your imagination. Picture yourself holding an apple. Your ability to see that in your mind is a result of you cognitively processing information in your mind.

It's important to remember that behaviour and cognitive processes are extremely closely related, and the differences between these are often not black and white. For instance, is feeling emotional a behaviour or a cognitive process? We can often see when someone is really happy or feeling depressed, but we can't see their feelings or their thoughts, which are equally important in experiencing emotion. Another example could be stereotypes: are these behaviours or cognitive processes? They involve thinking about people in a certain way, but they are closely related to how we might act towards them as well. Or what about attraction? This includes the way we think about someone, but also can affect how we act. Psychological disorders also encompasses visible and cognitive symptoms.

The study of observable actions without focusing on internal processes is rather limited, because these processes are often at the heart of our behaviour. How we think, or don't think, in certain situations can have big effects on how we behave. For example, if we're trying to understand why some people are more likely to react violently in situations when they feel threatened, focusing only on their reactions would give us a limited understanding of *why* they reacted that way. By going deeper and trying to understand their thought processes that lead to their violent reaction, we can get a deeper understanding of their behaviour.

As you can see, distinguishing between behaviour and cognition is pretty tricky. For the most part, distinguishing between behaviour and cognitive processes isn't

In the IB Psychology programme, all cognitive processes could be used in exam questions that ask about “behaviour.” However, not all behaviours could be used in response to questions about cognitive processes.



Attraction involves internal processes and observable actions. This is a good example of how our cognition and our behaviour interact (i.e. they can influence one another).

Psychology is the scientific study of observable actions and internal mental processes.

essential while progressing through this course. Having said that, as these two concepts are the core of psychology, it is essential that by the end of the course you have a firm understanding of a number of behaviours, cognitive processes, as well as multiple ways in which they interact.

Psychology is filled with these “grey areas” and things are not always black-and-white. In fact, they rarely are. Some of my students get frustrated and ask, “If there are no definitive answers in psychology why do we even study this subject?” As the course progresses it’s hoped you’ll be able to see your own answers to this question. If you can learn to appreciate grey areas and to think more deeply about them, rather than always trying to put the world in black-and-white terms, you’ll be able to consider and grasp increasingly complex ideas, which is an underlying goal of the IB Diploma Programme.

Guiding Question:

Why do psychologists study behaviour *and* cognition?

Abstraction Extension:

It’s already been explained how it’s often very difficult to distinguish between behaviour and cognitive processes. Looking at the list of cognitive processes provided in this section, can you think of any relationships they may have with particular behaviours? For example, language includes speaking but speaking is an observable action. The thinking about what to say and forming the words is the cognition, while the act of speaking and the manner in which someone speaks (e.g. body language, volume, etc.) are the observable actions that constitute the behaviour. Can you think of other examples of areas of uncertainty between what is “behaviour” and what is “cognition”?

If you’re interested...

There’s so much to learn in IB Psychology and so little time to learn it all, that these sections provide you with opportunities to explore possible areas of interest. There is a great collection of some of the most influential ideas in psychology in *50 Psychology Classics: Who We Are, How We Think, What We Do: Insight and Inspiration from 50 Key Books* by Tom Butler-Bowdon. The fact that this book has each theory divided into individual sections makes it easy to read little and often.

(b) Studying Individuals

The focus on *individuals* is where psychology is different to other fields of study, like sociology and anthropology. These subjects tend to focus on humans as they exist in groups, whereas psychology focuses on humans as they exist as *individuals*. That’s not to say that our individual behaviour and cognitive processes aren’t influenced by our social and cultural groups. In fact, the influence of our social and cultural environments is the subject of a whole unit in this textbook and is a recurring theme in other units as well. For instance, you will learn about how the culture you were brought up in may have affected your way of thinking about certain things and this might also affect how you act in certain situations. But whereas anthropologists would look at the cultural influence as a whole, psychologists look at the effect of the cultural influence on the behaviour and cognitive processes of *individuals*.

This is why it’s important to be very careful when making broad, sweeping statements and drawing generalized conclusions in Psychology: everybody’s different and so while we can observe general trends and patterns across large groups of people, there are nearly always exceptions in particular individuals. For instance, compare the following two statements:

- In one of her answers, Sarah writes that “...because of their cultural values, Japanese people go along with the group.”
- In one of his answers, Raffi writes that “...because of their cultural values, Japanese people may tend to go along with the group.”

I really want to emphasize the importance of the difference between these two statements and why Raffi’s is far more accurate and demonstrates a deeper understanding than Sarah’s. Sarah is making a definitive claim about Japanese people that suggests she thinks of all Japanese people as being exactly the same and behaving the same way when in a group. Sarah is treating all 120 million + Japanese people as the same, which means she either hasn’t thought carefully about the conclusion she is drawing, or she hasn’t thought about the words she is using to show her conclusions.



While it’s often very appealing to simplify the world and make generalizations, it’s important that you understand that generalisations aren’t always true. What happens in one culture, might not be the same in another.

Psychology is closely related to anthropology, sociology, biology and even philosophy.

Try to get in the habit of challenging your own conclusions. This is an important part of learning to think critically.

Variables and behaviours in psychology can **interact**, which means they influence one another.

Raffi, on the other hand, includes two very important clauses to his claim: “may” and “tend to”. The word “may” is important in this conclusion because it recognizes that Japanese people won’t behave the same way all the time, just like all humans. The phrase “tend to” also shows that while this is a pattern of behaviour, it leaves it open for exceptions. Later in this chapter you will be shown some guidelines when making conclusions about people’s behaviour and/or cognitive processes so you can come to show similar levels of thinking like Raffi and avoid over-generalizations like Sarah’s.

We’ve mentioned already that psychology involves studying cognition, behaviour and the social environment, but there’s one major factor that is missing: biology. Our thinking and behaviour is influenced by our internal biological processes, such as the function of our brain, levels of hormones and other chemical messengers in our body. Part of studying individuals involves the investigation of biological factors that affect, and are affected by, our behaviour and mental processes.

Guiding Question:

How is psychology different to other social sciences, such as anthropology and sociology?

Abstraction Extension:

Psychology involves a combination of many other subjects, such as Biology, Chemistry, Sociology, statistics and even Philosophy. One area that involves a lot of overlap between these subjects is the human brain. Both biologists and psychologists study the brain. How do you think a biological study of the brain might differ from a psychological one?

If you’re interested...

This introductory chapter doesn’t go into the history of psychology, which some of you might find interesting. The work of arguably the most famous psychologists, Sigmund Freud, is not included in this text. If you know about Freud and are interested in learning about his ideas, there’s a fascinating documentary called *The Century of the Self*. At time of writing this full documentary was available online. You can also find his full library online as well.

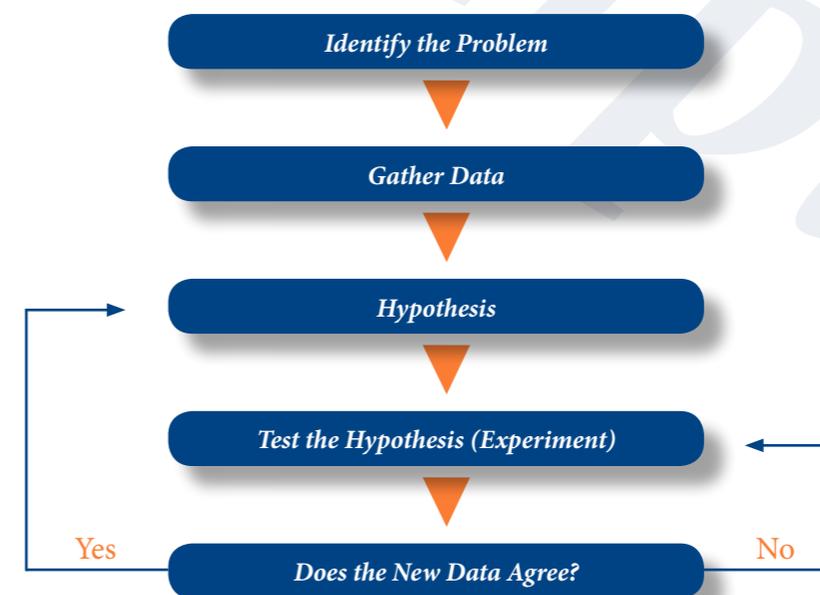
(c) Psychologists are Scientific

The term “scientific” has many connotations. In psychology it refers to following a scientific method when studying behaviour and cognitive processes in order to gather **empirical evidence**. In other words, **valid** and **reliable** evidence needs to be gathered to test ideas and theories.

The scientific study in psychology typically follows this pattern:

- 1) Observations are made (relating to behaviour and/or cognitive processes)
- 2) Background research is conducted
- 3) Hypotheses are formulated
- 4) Experiments or tests are designed to test hypotheses
- 5) Data are gathered and analyzed
- 6) Conclusions are drawn based on the analysis of data

This is an important process to follow in psychology because humans are such complex creatures. Our thoughts, perceptions and interpretations of others’ behaviour is also highly susceptible to our own biases, which is why a scientific method should be applied to develop valid conclusions. There is much more to know about the research process in psychology and understanding this process is a recurring theme throughout the course. Standard Level (SL) and Higher Level (HL) students need to have a firm grasp of experimental research methods as all IB Psychology students conduct experimental research for the Internal Assessment (IA). An understanding of research methods is also important for other areas of the course as well. HL students will go further in their studies of research methods, as this is a key point of difference between the SL and HL courses.



Psychology research is based on the scientific method.

It’s essential that you work to develop a scientific and analytical approach to your own study of Psychology. Part of the scientific approach involves gathering and scrutinizing evidence to test ideas. As you come up with your own ideas and conclusions, it’s essential that you analyze the evidence you have available to support your opinions.

You can read more about the concepts of **validity** and **reliability** later in this chapter. You might not be able to fully grasp what these mean this early in the course, but it is hoped that by the end of this course you will be able to.

Throughout this course you will be presented with a lot of studies to analyze and draw conclusions from.

There's a great TED Talk called "10 myths about psychology, debunked" that shows how ten common myths about psychology can be disproven through empirical research.

Many students make the mistake of ignoring the evidence or not thinking carefully enough about evidence before they make big claims in psychology.

In our course, the evidence is the research: the studies and the theories. The following sections aim to provide you with a brief introduction to these aspects of psychology and the further you progress through the course and the more studies you learn about, the more this will make sense. If you feel lost and confused now, try not to panic. A good strategy would be to make notes and write questions to yourself and then as you learn about more and more studies and you develop a deeper understanding of what psychology is all about, regularly revisit your notes until you have answered your own questions.

A beneficial habit to get into is trying to relate what you're learning about in class to your own personal experience and observations. The more you can connect what you're learning in the IB Psychology course to your existing knowledge, the more you will understand. This will help transform what you're learning about from abstract concepts to concrete examples. For instance, when studying criminology you learn about a theory of judgement and decision making. This theory includes two types of processing of information. Processing, judgement and decision making are all very similar and related, but slightly different, cognitive processes. The definitions of these will be hard to understand in the abstract, but if you can come up with your own concrete and real-life examples it will make them easier to understand.

Guiding Question:

Why is a scientific approach important when studying individual behaviour and/or cognitive processes?

Abstraction Extension:

Tolerating Uncertainty: When does research become scientific? In this course you need to become trained to tolerate uncertainty, which means acknowledging and understanding that often there are grey areas. Most concepts you will learn about in Psychology can't be viewed in black-and-white terms and scientific research is one of them. This textbook contains only psychological research that has been published in peer-reviewed journals, but does that mean that research that follows the scientific method that hasn't been published is any less valid and/or useful? To what extent is your own observation of other people a valuable way of "knowing" something in Psychology?

If you're interested...

Some of the most famous psychologists and their experiments have been summarized in Lauren Slater's book *Opening Skinner's Box*. This is written for a popular audience so it's generally pretty accessible for a student who is interested in reading more about some of the historical and groundbreaking studies in psychology.

1.2 Psychological Studies

How do we know what we know in Psychology? Part I

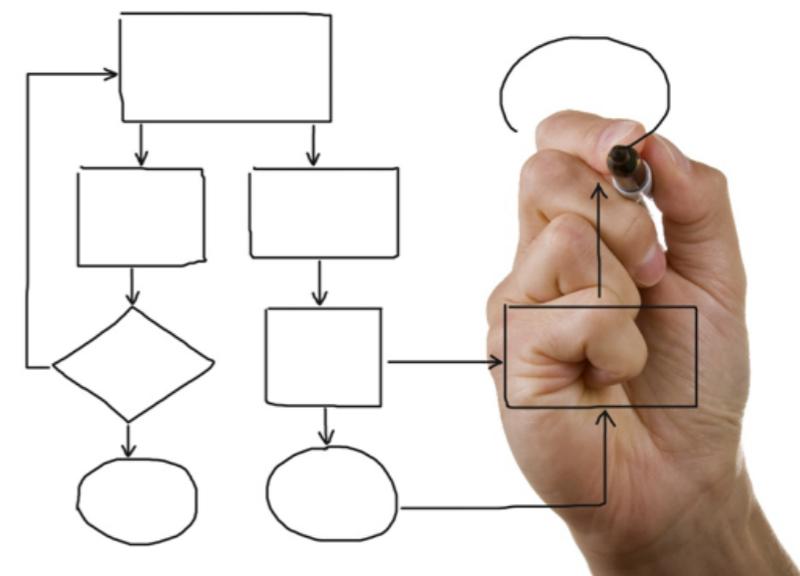
(a) Variables and Relationships

As you've already learned, psychology involves scientific investigations. In order to follow the scientific process, research must be conducted. Most psychological research is focused on studying relationships, but not relationships as in romances or friendship (although this is an area of study and one we'll look at in the "Love and Marriage" unit). Psychology involves the study of relationships between **variables**. A variable is something that can change or vary. Remember that as you are now a psychologist one of your key goals is to understand *why* people behave and think the way they do. In order to understand "why" (i.e. the reason behind something) we have to investigate factors influencing behaviour and cognitive processes. Thus, psychological research focuses on studying the relationships between factors that may influence behaviour and/or cognitive processes.

I'm going to use a fictional example of a really basic idea to help my explanations of psychological studies. Let's imagine that I've invented a pill and I think this pill will help you remember more after reading. Put simply, it improves memory of what you've read. My pill's called Rememberol (patent pending!) Before I can make solid claims about Rememberol's effects on memory I need some scientific evidence so I need to conduct some research. In this instance, I'm going to investigate the relationship between two variables: the pill (Rememberol) and memory.

If I got 20 students to take Rememberol and then did a test to see if it worked I couldn't make valid conclusions. Why not? I don't have anyone to compare them to. This is why in many psychological studies² there is an **independent variable** (IV). Hopefully you are already familiar with independent and **dependent variables** but just in case we'll have a short refresher course here.

The **independent variable** is the variable that the researcher believes will



Analyzing psychological studies takes careful thinking and processing. You need to know the individual bits of information (building blocks) and then try to see how they relate.

² I say "many" because qualitative research methodology doesn't have variables, but this is an extension topic. A vast majority of psychological research is quantitative in nature, and at this early point in the course we'll focus on just quantitative studies.

At the heart of psychology is the study of relationships between variables and behaviour.

have an effect and so it is what they manipulate. By having an independent variable we are able to make comparisons between groups and in making these comparisons we can draw conclusions about effects of one variable on another. For example, I might conduct an experiment whereby 10 of the students in my study take Rememberol and the other ten don't. Now I can make comparisons between the two groups: if the Rememberol condition has better memory scores on my test, I have some evidence that suggests it really works.

The **dependent variable** is the effect of the manipulation of the IV. It is what is measured by the researchers. So in my experiment on Rememberol, my DV would be the scores of the test because this is what was measured; it was what was affected by the IV.

When understanding studies, it can be helpful to identify the IV and DV in the study. This will help you identify the direction of the relationship being investigated. After you know the IV and DV, you will be able to draw conclusions.

There are many other important components to psychological research besides just the IV and DV and these will be explored in-depth later in the course.

It's also important to note that there are *many* components to conducting studies in psychology and this is a *very* brief introduction. The key point to understand at this stage is that by making comparisons between groups in studies, psychologists gather evidence and draw conclusions about cognition and behaviour.

Guiding Question:

What's the difference between an independent variable and a dependent variable?

Abstraction Extension:

Is psychology a "science?" "Social Science" is a name commonly given to subjects like Economics, History, and Political Science. Natural Science is the name commonly given to subjects like Biology, Chemistry and Physics. From what you've learnt so far about Psychology, do you think it's more of a Social Science or a Natural Science?

If you're interested...

"Crash Course" is a youtube channel that has many useful videos on a range of subjects. Their videos on psychology are really well done. If you're interested, they have one called "Episode 2: Research and Experimentation." This might provide you with more helpful explanations of research and studies in psychology, although be warned that they use a lot of jargon (which we'll explore later in the course).

You have probably learned about variables in science class already. Try to draw on your prior learning to understand how these are used in psychological research.

(b) Applying Conclusions

The experiments explained throughout this textbook have important and significant relationships between variables and it's this relationship that you need to draw a conclusion about. The studies are used to help facilitate your acquisition of important conceptual understandings related to psychology. Some of those conceptual understandings are related to:

- How our physical environment can affect behaviour
- How culture can affect thinking
- How biology can affect thinking
- How thinking can affect behaviour
- Etc. etc.

You'll notice that these are very broad, but they're all about relationships. In particular, they're relationships between variables (e.g. biology, culture and our environment) and behaviour and/or mental processes (e.g. thinking).

In order to draw a conclusion about these relationships between variables, you need to first know the **methodology** used. The independent variables and dependent variables are important parts of this methodology, as have been explained in the previous section. Once you know the methodology, you need to understand how one variable affects another. Moreover, you'll need to *explain* your understanding of that relationship.

Sometimes you might find it helpful to identify the **aim** of a study. The aim of a study is simply a one or two sentence statement that identifies the relationship being investigated between the IV and the DV in a particular study. For instance, the aim of my experiment was to see if Rememberol would have an impact on memory.

Two other key components of the methodology include:

- **The Participants/Subjects:** Who took part in the study? (e.g. age, gender, nationality, etc.)
- **The Procedures:** What were the participants asked to do?

A key component of drawing conclusions from studies are the results. The results are the measurement of the dependent variable. In my Rememberol study the results would be the scores the participants got on their tests. In order to see if my drug actually has an effect I need to compare the results from my **treatment group** (those that got the pill during revision) with my **control group** (those that didn't take the pill). If both groups' scores were the same it would suggest that my pill *doesn't* have an effect on memory.

After you have drawn the conclusion it is important that you can apply it to a particular question or problem being asked. Throughout this textbook you are provided with guiding questions



I'm using my fictional example of "Rememberol" just to help you understand a few basic ideas about psychological research. Hopefully as you learn about real research you'll be able to apply these concepts to real studies.

It's important that you use the guiding questions in this textbook to help you draw conclusions about the research you are presented with. After you draw your conclusion, remember to go further and challenge your own conclusions by thinking critically.

Methodology refers to the aims, procedures, participants and equipment used in the study.

whenever a major piece of research is explained. These guiding questions are designed to help you think carefully about the research and the relationships they demonstrate. The overview of the IB course provided later in this chapter will show you more precisely the variables, behaviours and cognitive processes involved in the relationships that you need to understand.

There is *a lot* of other aspects involved in psychological research and these will be explained in more detail in later chapters. They are not explained here because they will probably make more sense *after* you have a good knowledge base of a range of studies first. At this stage, it's just important to know what to look for in studies and how to draw conclusions.

You will have *many* studies that you will need to remember by the end of this course. In order to remember which study is which, there are a couple of things you can do. Sometimes very famous studies become known by a common name. For instance, you may have heard of the famous psychological study, 'The Stanford Prison Experiment.' It can be helpful sometimes to give a study a name so it's easy to remember and identify what you're talking about, like 'The Iowa Gambling Study.' However, there are a number of different studies that use the Iowa Gambling Task and so calling it this might not make it clear what study you are referring to. Nevertheless, you can identify studies by referring to them by a common name, like 'Asch's Conformity Studies,' 'The Bobo Doll Study,' 'The Robber's Cave Experiment,' 'The Iowa Gambling Study,' etc. Or another strategy to give you something concrete to remember is to refer to the researcher/s name/s, e.g. Milgram, Goetz et al, Sherif, Bandura, etc and the year of the study. This is also helpful for examiners to identify the particular study you are referring to in exam answers.

Guiding Question:

How does understanding relationships between variables (e.g. IVs and DVs) assist in applying conclusions in psychology?

Abstraction Extension:

The Rememberol study I have explained is an example of a basic experiment: it manipulates an independent variable in a very controlled situation. You may have conducted many of these studies in your science classes. But what are the limitations of conducting experiments in very controlled environments?

If you're interested...

There's an interesting article on *Huffington Post* called "10 Psychological Studies That Will Change What You Think You Know About Yourself." Not only are these fascinating studies and many of which we'll learn about, it might give you a good chance to practice identifying IVs and DVs and drawing conclusions. The more you can familiarize yourself with some basic studies at this early stage, the more confidence you'll gain to tackle more difficult studies later.

(c) Causation

There are two types of relationships that can be concluded from psychological studies: **causational** and **correlational**. As you learned in the previous section, when you are analyzing a study to draw conclusions you need to have a question or problem in mind that is guiding your analysis. As you analyze the results and draw conclusions in response to this question/problem, you will be deducing either a correlational or a causational relationship.

You might be familiar with these concepts already from other subjects, such as Science and Maths, but let's have an overview of these concepts just in case.

Causation means that one thing causes another. In psychology it refers to one variable *causing* a change in another variable. In order to claim a causational relationship between one factor and another *all* other possible factors have to be eliminated so that one variable is shown to have a high probability to have a *direct* result on something. i.e. one variable *causes* an effect on another.

For example, in order for me to conclude that Rememberol *causes* improved memory I need to make sure that there were no other possible factors influencing the dependent variable in my experiment. That is to say, I need to make sure there was nothing else that might explain the differences between my treatment and control groups. For instance, what if one group just naturally had a better memory than the other group? Or what if just by taking a pill they *believed* that they were going to do better and this made them concentrate more?

This is one major advantage of the laboratory experiment: it enables researchers to carefully design experiments that have many **controls** in place. A control is something that helps isolate the IV as the only variable influencing the DV. If there are other possible factors that might influence the DV (e.g. the age of the participants, their general memory abilities, etc.) these are called **extraneous variables**. A variable that does have an effect on the DV that was not intended is called a **confounding variable**.

For example, the noise level in my testing room during my Rememberol experiment might be an extraneous variable because it might affect the concentration levels of participants. I can control this by having all participants in the same room at the same time. However, if half of my control group turned up late and had less time than everyone else and this affected their results, this would be a confounding variable because it is not the IV and it is affecting the DV.

Here's another example: in many countries cigarette packets come with warning labels that say "SMOKING **CAUSES** LUNG CANCER." This means that if you smoke cigarettes regularly, there is a very high chance that you will develop lung cancer. In this instance, the variable (smoking) has a direct result (lung cancer). Before governments could pass laws that required cigarette packets to have that warning label there would have been lots and lots of research and studies conducted to determine that there was a direct causational relationship between smoking and lung cancer. In fact, in some countries the word "may" has to be put in there so it reads: "Smoking *may cause* lung cancer" because even this relationship may not be definitively causational.



If a study showed that people who read more are smarter, could you say that reading causes people to be smarter?

Causation and correlation are introduced early in this course because they're important concepts. But you may not grasp them just yet as you haven't had much practice looking at real studies. As you progress through the course, keep referring back to these concepts to make sure you understand and can apply them.

An **extraneous variable** is any variable that is present in the study that is not being tested. A confounding variable is an extraneous variable that has had an effect on the dependent variable. We can only deduce causation if it's *only* the IV that affects the DV.

Many students make the mistake of blindly memorizing as many details about a study as possible. You need to be focusing on understanding the relevant details that help you to draw conclusions about relationships between variables and behaviour.

A laboratory experiment is also called a true experiment, because they do not always happen in laboratories.

In psychology, causal relationships are concluded from **laboratory experiments**. In a laboratory, all extraneous variables are controlled for. That is to say, every variable that may affect the DV is kept constant so it's only the IV that is having an effect on the DV. It is only in a laboratory (i.e. highly controlled) environment that this can happen.

For instance, if I wanted to conclude that Rememberol *causes* an increase in test scores, I would need to design an experiment in a highly controlled environment that controlled for all extraneous variables so they wouldn't confound my results. Here is a list of some possible extraneous variables relating to my participants that may affect my DV (test scores) that I might need to control for:

- Hours of sleep
- Diet
- Prior knowledge
- Academic ability
- Interest in the subject
- Language
- Age

In order for me to conclude that my learning pill Rememberol *causes* grades to increase I would need to design and conduct numerous studies that controlled for possible extraneous variables so I could isolate the IV (my drug) as being the variable that is directly affecting the DV (memory, as measured by test scores). Again, there are many terms used to describe how laboratory experiments are designed and you'll learn more about these later in the course.

Throughout this course you will learn about laboratory experiments that investigate relationships between variables. Be wary, however, that just because an experiment is a laboratory experiment it doesn't always mean that the relationship is causal.

Guiding Question:

How can laboratory experiments demonstrate causal relationships?

Abstraction Extension:

Human behaviour doesn't occur in a laboratory and this is a major limitation of the laboratory experiment. You'll learn about many other types of research methods that are used to understand human behaviour, including case studies, natural experiments and correlational studies. What are some relationships between variables (e.g. cognitive processes and/or behaviours and factors influencing them) that you think could not be tested in a laboratory setting?

If you're interested...

There have been recent film adaptations of the stories of two of the most famous experiments conducted in Psychology: the Stanford Prison Experiment (Zimbardo) and Milgram's experiments on obedience to authority. The films are called *The Stanford Prison Experiment* and *Experimenter* respectively. Remember that Hollywood has a tendency to alter facts to make better stories, so be wary of treating these films as factual representations of what really happened.

(d) Correlation

This section aims to provide you with an understanding of the differences between causal relationships and correlational ones. However, it's important to note that it's not expected for you to fully grasp these differences so early in the course. The first step in understanding the research that you are going to study is to identify the obvious relationship first. That is to say, how one variable affects another and how this is shown in research. For example, how my drug Rememberol affects memory and how my experiment shows this. The next step *after* you draw this obvious conclusion, is to reflect on whether or not the relationship is causal or **correlational**. This requires really deep thinking and will take a lot of practice. A good strategy is to regularly review these introductory chapters throughout the course to keep a gauge on your own level of understanding of these tricky concepts.

Historically, laboratory experiments have been the most popular research method in psychology. And while there are still thousands of laboratory experiments conducted around the world every year, there are significant limitations in studying human behaviour only in the lab. One limitation is based on the fact that humans might not behave naturally in a laboratory because it's not a normal environment. This is one reason why **field experiments** are conducted. These are experiments where the independent variable is manipulated in a natural setting, for example a shopping mall, a summer camp or in a hospital. I might give my Rememberol drug and a placebo to two groups of IB students during their exam review session and then my DV would be their actual exam results.

But once you get into the "field" it's difficult to control for extraneous variables, so identifying causation becomes harder. For example, how do I know that all my IB students took Rememberol when they were supposed to? Perhaps some of the exams were more difficult than others. Researchers may have to make a compromise between **ecological validity** and establishing causal relationships. Ecological validity is a term used to describe how accurate an experiment's conditions are in replicating

Correlation and causation are two more examples of grey areas in psychology. Some studies might show a causation of effect, but not necessarily a causation of behaviour. For example, my study could show that my Rememberol causes increased activity in the memory part of the brain, but I may not be able to conclude that this causes improved memory.



It's often very difficult to draw causal relationships in human studies because there are so many differences (variables) from one person to the next, and from one group of people to the next.

what happens in the “real world”. There’s more about this concept and how to apply it properly later in this chapter.

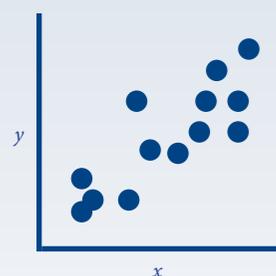
Similarly, researchers can’t always create the independent variable themselves in the laboratory or in the field. Let’s say, for instance, that I wanted to study a relationship between brain damage and decision making. To do this I want to compare the difference between people with brain damage and people with healthy brains. I wouldn’t find many volunteers who would want to have their brain damaged simply so I could study them. But I can find people who have *existing* brain damage and ask if they want to participate in my study. When the independent variable is naturally occurring it’s called a **natural experiment**. But like with field experiments, the researcher in a natural experiment can’t control for extraneous variables so establishing a causation is difficult as there are many possible variables that may be affecting the DV.

Maybe, for example, I have a hunch that Rememberol works better for boys than it does for girls. To test this, I can get 20 girls and boys in an experiment and then give them the drug followed by a test. I can then compare the results between the boys and the girls to test my idea. You can see from this example that the independent variable is the gender of the participant (boy or girl). But you could imagine how many extraneous variables there are. So even if girls did better on the test, I couldn’t say necessarily that Rememberol *caused* this improvement in the test because it is possible girls are just better at taking tests than boys. Therefore, I can only say that the correlation exists because the test-taking ability of boys and girls is a potentially confounding variable.

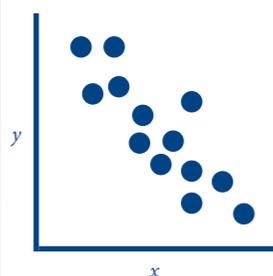
Where we can’t find a causation but we know that one variable might affect another variable, we call this a correlation. A correlation means that there’s a relationship between two variables but we can’t claim it to be causal. We *might* not be able to conclude that there is a **cause-and-effect** (i.e. causal) relationship because:

- There are too many extraneous and/or potentially confounding variables.
- We do not know the direction of the relationship (which variable is affecting which).

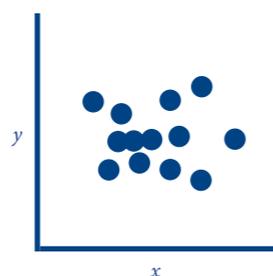
For instance, research has shown that on average the more fish a country eats the lower the rate of depression (Adams et al, 1996). This is a **negative correlation** as while one variable increases (eating fish) the other variable decreases (depression). From this statistic, can we say that not eating fish *causes* depression? No, we can’t say that because there are too many other variables. For instance, perhaps countries that eat lots of fish live nearer to the ocean and those that don’t live away from the ocean and it’s this proximity to the ocean that affects depression, not the diet.



Positive correlation



Negative correlation



No correlation

A **positive correlation** is when as one variable increases, so does the other. For example, a positive correlation might be between hours studied and test scores: the more hours on average students study, the higher on average their test scores are.

Sometimes in correlational studies we don’t know the direction of the relationship. Perhaps variable (a) is affecting variable (b), or variable (b) is affecting variable (a). For example, in the fish-depression relationship, it could be that the fact that the more fish a person eats

the less likely they are to get depressed. Or, it could be that the more depressed a person is the less they want to eat fish. When the direction of the relationship is uncertain like this, it’s called **bidirectional ambiguity**.

Laboratory, natural and field experiments all have independent and dependent variables, which is why they’re called experiments. Some studies don’t have *independent* and *dependent* variables, however, they just have variables. These are called **correlational studies**. This may seem quite confusing now and so it will be explained further later in the course. By this stage, it’s simply hoped that you understand what you’re looking for when reading studies and the general difference between a laboratory, field and natural experiment.

Guiding Question:

What is the difference between causation and correlation in psychology studies?

Abstraction Extension:

Understanding the difference between causation and correlation is a key to doing well in IB Psychology. Moreover, if you can clearly explain *how* specific studies demonstrate specific causal or correlational relationships between variables you will do very well in this course. One study mentioned in the TED talk in this section’s “If you’re interested” claims that people who use Google Chrome and Mozilla Firefox internet browsers are likely to stay in their jobs 15% longer than those who use Explorer or Safari. What’s the obvious causal relationship to deduce from this finding? What’s a possible argument that could counter the causal one?

If you’re interested...

Adam Grant’s TED Talk “The surprising habits of original thinkers” is where the above stat regarding internet browsers came from. This talk discusses some really interesting findings he’s discovered through his work as an organizational psychologist. If you’re a chronic procrastinator, you might find this talk interesting.

1.3 Psychological Theories

How do we know what we know in Psychology?

Part II

(a) Psychological Theories

What we “know” in psychology comes from research. When students hear the word “research” they naturally think of studies, but I can’t stress enough how important it can be to include theories as part of your understanding of the term “research” in psychology. One practical reason for this is that in your exams you need to demonstrate knowledge and understanding of *research*: many students forget that theories count.

In general, a theory is an attempt to describe and/or explain a **phenomenon**. So in psychology, a theory is an attempt to describe and/or explain a particular psychological phenomenon. The term phenomenon (plural – phenomena) is a useful one to know as you can use it as an umbrella term like I’ve just used it in my above definition of a psychological theory. A phenomenon is something that can be observed to occur, especially if there’s some questions or uncertainty about its cause or origin. One example of a psychological phenomenon is **confabulation**. This is when you can remember something that never really happened. Another example of a biological phenomenon is **neurogenesis**: the brain’s ability to grow new cells. You’ll be exposed to a plethora of new terms throughout this course, but they all help you to explain things more clearly.

But I digress. Here are *some* of the theories that you will learn about in this course:

- Realistic Group Conflict Theory
 - *An attempt to explain how competition and co-operation between groups can influence conflict.*
- Social Identity Theory
 - *An attempt to explain how belonging to a group can influence individual thinking and behaviour.*
- Social Cognitive Theory
 - *An attempt to explain how an individual person’s characteristics (including biology), their behaviour and their environment all influence one-another.*

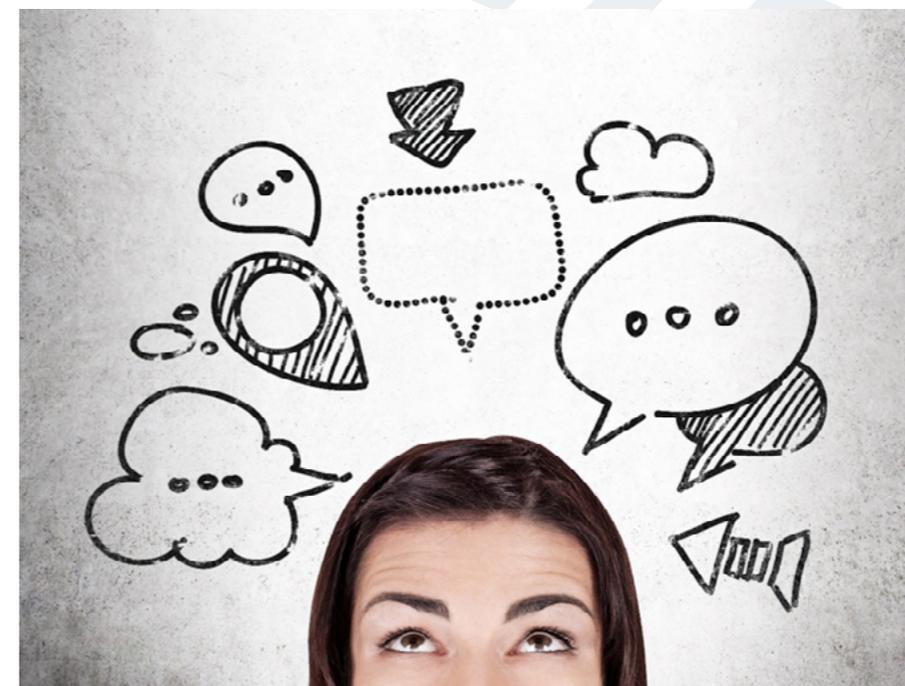
So when learning about psychological theories the first step is to figure out what the theory is trying to explain. In other words, what’s it a theory of, exactly? A big part of knowing the theory involves knowing the behaviour and/or cognitive process involved.

One example is Bandura’s social cognitive theory (SCT). An important first step is understanding SCT is to figure out what it’s attempting to describe and explain. This theory **posits** that behaviour, the environment and an individual’s characteristics all influence one another. After you understand this tricky idea, it might then be necessary to figure out how SCT applies to the context of criminology. After you can explain how SCT is relevant in criminology, you can then start thinking about other fields of study that SCT might be applicable to. As you learn more throughout the course, you’ll be able to make more and more connections, which leads to deeper understanding.

It’s important to note that there are multiple times when psychological theories might be relevant, even if they’re not what you’re *immediately* studying. This is where practicing your thinking skills is really important: you can make connections between various ideas even when they’re not immediately obvious or concrete. For instance, after you learn about the dual processing model of decision making you may be able to apply it to numerous different areas of study. For example, you may begin to wonder if this could explain why some people gamble or why some can resist temptations better than others.

This is another reason why making connections and asking questions is really valuable: as you go through the course try to make connections with what you’re learning in class to what you see in the “real world”. Furthermore, try to make connections between what you have learned in one part of the course with another. Identifying and asking questions about these connections will help you develop an in-depth understanding of psychology and will lead you to enjoy the course a lot more. Moreover, as a teacher, I love hearing students ask questions that shows their in-depth thinking about what they’re learning and I’m sure your teacher will, too!

The relationship between theories and studies is important to understand, because studies form important pieces of evidence that can demonstrate and support, or challenge and contradict theories. Studies can be used to support key claims of theories if the relationships stated in the theory can be demonstrated by results of studies. For example, one interesting idea about social cognitive theory is that our behaviour can be influenced by our internal characteristics, including our biology. You’ll find numerous examples throughout this course showing how our behaviour can be influenced by our biology. But the theory also states the relationship can happen in the other direction: our behaviour can influence our biology, and when you learn about neuroplasticity you’ll see how this can happen.



To do well in IB Psychology you need to be actively thinking, processing and questioning.

A psychological **phenomenon** refers to an interesting behaviour or mental process that can be observed to occur. There may be some questions surrounding their origin, as well.

Psychological theories provide plausible explanations for relationships between variables and behaviour.

Biological evidence for theories of cognition and behaviour are strong sources of supporting evidence. For example, when studying social identity theory you are going to see how there might be some biological evidence to explain discrimination and prejudice.

Understanding theories, therefore, still requires investigating relationships as theories include explanations of relationships between variables and behaviour. Moreover, being able to see how studies relate to theories is another important skill to develop as it helps to evaluate the validity of particular theories. There is more information later in this section about how to evaluate psychological theories.

In psychology we also study models of thinking and behaviour. Whereas a theory explains relationships between variables, models provide an illustration for how a cognition or behaviour might happen. Here are two examples of models that we will learn about in this course:

- Dual Processing Model of Decision Making
 - *A description of different types of thinking (fast and slow).*
- Multi-store Model of Memory
 - *An attempt to describe the process of memory formation.*

Guiding Question:

What do psychological studies and theories have in common?

Abstraction Extension:

An important reason to practice your abstract thinking skills is that many students treat theories as “facts” because they “read it in a textbook.” The difference between a theory and a fact is quite subjective. For example, is the Theory of Evolution a theory or a fact? Is Climate Change a theory or a fact? These are highly debated questions and the same goes for psychological theories. Learning how to question and challenge ideas is another underlying goal of this course and is the primary objective of these abstraction extensions. After you can determine a relationship between two things (as directed by a guiding question), the next step is to think abstractly about that relationship. When evaluating theories you can first explain studies that support or demonstrate key claims of the theory, and then offer a counter claim that shows evidence that challenges or contradicts the theory.

If you're interested...

There's a good TED Talk by Ben Ambridge called “10 myths about psychology, debunked.” This might be a good place to start your study and to give you a better idea of what this subject *isn't* about.

1.4 Evaluating Research

How do we evaluate studies and theories in Psychology?

The information provided in the rest of this chapter is for reference purposes. Much of this information may not be very useful or helpful early in this course because you won't have the context to make sense of it. Hopefully it will be useful as you progress through the units and begin to develop more of an understanding of what is required in IB Psychology. Your learning in this course will compound, meaning it grows over time as you continue to learn. Each piece of knowledge you acquire and relationship you understand will build on prior learning and will facilitate the learning of the next new topic. This text has been designed to facilitate this process so that each topic isn't taught as an individual entity, but that the themes running throughout each unit will enable this development of your learning. Reading these sections throughout the course could also make for excellent tasks to extend yourself and to prepare for important assessments.

(a) Critical Thinking

After reading the material so far in this chapter, you should have a general idea of what you're supposed to understand in the psychology course. But you're also expected to be able to develop the skills to go further than understanding and to be able to reflect critically upon your own understanding. The IB Psychology guide provides several areas of your understanding that you can reflect upon:

- Research design and methodologies
- Triangulation
- Assumptions and biases
- Contradictory evidence, alternative theories or explanations
- Areas of uncertainty

Essentially, this means that after you demonstrate a conceptual understanding of a significant relationship in psychology, you then need to reflect on that understanding and this is an important next step to aim for. Coincidentally, it's also what the abstraction extensions are designed to help you with. You will learn more about what these areas of critical thinking mean as the course progresses, but here's a quick introduction to each concept and how it might be applied.

Research design and methodologies: you may demonstrate critical thinking about a study that you have used to demonstrate a significant relationship. This would involve analyzing and critiquing the methods of the study and explaining how this might affect the validity of the conclusions and applications of the study itself. For example, if a natural experimental method was used this could affect the types of conclusions that could be drawn and the applications of the findings. The next sections explain why some forms of methodological evaluation are more encouraged than others.

Triangulation: To triangulate data in psychology means to get information (data) from more than one source. It helps to strengthen the validity of conclusions. There are a few types of triangulation, including **methodological triangulation**, **researcher**

Critical thinking involves asking questions about significant relationships.

triangulation and **data triangulation**. These are explained throughout the abstraction extensions. You can reflect on applications and conclusions regarding relationships by explaining how triangulation may affect their validity.

Assumptions and biases: An assumption is something that is believed, without necessarily having any proof or evidence. Bias could likely refer to researcher bias. Assumptions and biases can influence the validity of conclusions in many ways. It's hoped that you can learn to try to see where they *may* have influenced research or conclusions.

Contradictory evidence or alternative theories or explanations: There's often more than one way to explain a phenomenon in psychology so thinking critically could involve offering a different explanation for a relationship you've explained, or contradictory evidence that challenges that relationship in some way. If you focus on biological explanations of behaviour, for instance, you could counter with an explanation of how sociocultural factors may be influential.



The IB Psychology course is designed to develop your knowledge, understanding and thinking skills.

Areas of uncertainty: This is my favorite critical thinking criterion because it's so vague that it can be applied in so many ways. It really leaves you freedom to think critically in multiple possible ways. For example, a "discussion" can involve hypothesizing, so if you are discussing a relationship you could come up with interesting hypotheses as to how that relationship might be applied in multiple ways, but as it's only a hypothesis you can say that it's an "area of uncertainty." Correlation vs causation might also be relevant in a discussion of an area of uncertainty.

What all these criteria have in common is that they are encouraging you to think beyond the concrete information you are presented with. One major goal of the IB Psychology course is that after completing this course you would have become more than just a passive receptor of information, more than just a sponge who is content to have information poured into their brain without questioning or challenging it. It's hoped that you will learn to understand ideas and complex concepts, but that you'll be able to go further and challenge them, including challenging the very evidence upon which they're based.

You'll see that evaluating research only covers some of the ways you *might* demonstrate critical thinking. You can learn more about evaluation of studies and theories in various chapter. They are not included here because without the context of understanding the studies being evaluated, they wouldn't make much sense.

There is a very good possibility that you won't need to evaluate *any* studies in your exam answers. Spending copious amounts of time in the beginning of the course learning how to do this, therefore, might be counterproductive, confusing and a bit meaningless. Nevertheless, an important criterion for your essay answers is "critical thinking". Critical thinking can mean a lot of things. The IB Psychology subject guide defines it as having an "inquiring and reflective attitude to (your) understanding of psychology."

The IB defines evaluation as making "an appraisal by weighing up strengths and limitations." When evaluating studies and theories, there are some guidelines you can follow to make such an appraisal. Fundamentally, an evaluation involves clear explanations of the strengths and limitations. However, you will not be able to provide clear evaluations of a study unless you fully *understand* the relationship it is demonstrating and you can *apply* that study to a particular problem or question. That is to say, you need to be able to **describe** the study, then **explain** it, and only after this can you truly provide a valuable and insightful **evaluation**. Assessing the strength/s of a study, therefore, include explaining why it's valuable in demonstrating a significant relationship. The limitations include explaining reasons why it might not be so applicable in demonstrating that significant relationship.

Investigating psychological studies, therefore, first involves *knowing* the study. What were the variables and the relationship investigated? Who took part? What were they asked to do? What did they find out? Etc. You need to know the aims, methods and results of the study.

The second step involves understanding and application. You have to know *how* the study demonstrates a significant relationship and you have to be able to apply that in response to a particular question or problem. Too many students focus on blindly memorizing aims, methods and results without thinking carefully about the significance or applications of the study in the first place. Knowing the methodology is only important if it helps you apply the study to show a conceptual understanding of a psychological phenomenon. Overviews of the relationships you need to understand are provided later.

After you understand the applications and significance of the relationship/s demonstrated in the study, you can then reflect critically about your own understanding of the evidence.

There are three primary ways you can think about evaluating studies:

- **Internal Validity**
- **Reliability**
- **External Validity**

Remember that the information in these sections is for reference only. It's not expected that you will be able to fully grasp these concepts at the beginning of the course.

You will have multiple opportunities to practice your critical thinking throughout the course. It's important that you don't rush through learning the basics first.

(b) Internal Validity of Studies

The internal validity of a study refers to the extent to which the study *actually* demonstrates the relationship that it intended to. In this instance, an explanation of a limitation of a study could involve explaining possible confounding variables that might have affected the results. For example, if I conducted my Rememberol study on students and measured its effect on test scores in English, a critique of internal validity would involve investigating my methodology. Were the questions in my test fair? Was the test a good measure of memory? Were all extraneous variables controlled for, or might there be some other variables influencing my results?



Before I could say that my Rememberol experiment would have high internal validity, I would need to make sure that the pill was the only variable affecting my dependent variable (e.g. effectiveness of studying).

It is far easier to include explanations of the *strengths* of studies that we use in this course in relation to internal validity, than it is to explain potential *limitations*. After you learn about controls later in the course when you are designing and conducting your own experiment, you'll be able to identify controls more easily in other examples of research. When asked to evaluate a study, therefore, you'll be able to see how they aimed to ensure internal validity by employing such controls. This will allow you explain strengths of the study, which is an important part of evaluation.

It is extremely difficult to explain the limitations of the studies used in this course in terms of internal validity for a number of reasons. First of all, the studies that we use have been published in **peer-reviewed** articles, carefully designed by extremely professional and experienced researchers and highly scrutinized by other psychologists. It would be very difficult for a first year high school psychology student to notice a limitation that someone else hadn't already noticed. Therefore, the only real critique that you would be expected to offer in terms of internal validity would be one that was probably proposed by someone else (e.g. in a textbook). In this case, you are not demonstrating *your* critical thinking, you are demonstrating your ability to regurgitate someone else's.

Asking you to independently evaluating internal validity in all the studies we use in this course would be as challenging as asking you to evaluate Dickens' use of imagery in *Great Expectations* - not impossible, but very challenging.

Peer-reviewed journal articles are those that have been analyzed by a range of other psychologists before being published. This helps to ensure they are credible sources of information.

This is why explanations of evaluation cannot be found in this text. Telling you what others have concluded about the strengths and limitations of theories and studies would only increase the content of the course and limit the development of your own thinking skills. Trust me – it's far better to figure out how to think critically for yourself than it is to memorise all the possible statements of strengths and limitations of *all* the research you need to understand.

A second reason why I discourage trying to evaluate studies based on internal validity is that it requires an enormous increase in additional amount of methodology that you have to study. In this course you read about new studies almost every lesson. In order to try to evaluate their methodology to assess internal validity would involve in-depth descriptions and scrutiny of their methodologies, and since our primary purpose in using studies in the first place is to develop conceptual understandings of significant relationships between variables, behaviours and cognitive processes, we only need to look at the methodology in as much detail as is required to show that relationship. Evaluating research is a secondary purpose to developing conceptual understandings of relationships, so internal validity simply adds a lot more potentially unnecessary content.

When you will be expected to critically evaluate a study based on its internal validity is when you conduct your own experiment for the internal assessment. It is during this chapter and the qualitative methods chapter that you will learn about evaluating methodology based on internal validity and in your report where you will be expected to demonstrate your ability to assess internal validity of research. Higher Level students may also demonstrate this in their third question in Paper Three.

(c) Reliability of Studies

Reliability refers to the extent to which the study has been **replicated** (copied) and similar results have been obtained. If a study gets results one time and in one experiment, it might demonstrate a relationship but this may only have happened once. Perhaps it was a fluke or they just got lucky. A study can increase its reliability by having many different researchers conduct the study over and over, on different participants, in different locations and in different situations. If a study gets the same results over many **replications** it can be said to have **test-retest reliability**.

Much like the reasons for not evaluating studies based on internal validity, this textbook is not always crafted to help you evaluate studies based on their reliability. There are some good reasons for this. Firstly, the studies that have been included in this textbook, generally speaking, have been replicated and their results have been shown to be reliable. And much like internal validity, explaining strengths or limitations of reliability involves more content and more memorization: it doesn't necessarily demonstrate your critical thinking ability.

For example, the best explanation of test-retest reliability you could really hope for would be: "this study has been replicated many times and so it has test-retest reliability." This could be followed by describing a study that used the same or similar methodology and got the same (or different) results. Understanding reliability and adding more studies to do this would add more content that is highly likely to be unnecessary and counterproductive to developing other essential conceptual understandings. The major aim of this text is to reduce all unnecessary content to free up time to develop a deep understanding of important psychological concepts.

A study has high internal validity if it was only the IV that affected the DV. It would be very difficult for you to evaluate existing, peer-reviewed research for internal validity, so it's recommended that you focus on external validity instead.

Your teacher may disagree with my approach to teaching the evaluation of research. As always, you should always put your teacher's advice ahead of my personal opinions.

In order to know if a study has test-retest reliability you need to know of other studies that have investigated the same relationship. Discussing this concept in essay answers doesn't really demonstrate critical thinking: it demonstrates knowledge.

(d) External Validity and Generalizability!

There are two more concepts to understand when evaluating research and they are the concepts that I believe are most useful to understand and apply when evaluating studies: **external validity** and **generalizability**. External validity means the extent to which the results of a study can be **generalized** to another context. By context, I mean time, place, situation, group of people, etc. Generalizability refers to the extent to which we could expect to observe the relationship demonstrated in the study in another context. There are key terms that are explained throughout the text in the abstraction extensions to help you develop your ability to consider generalizability. Three of these are **ecological validity**, **mundane reality**, and **population validity**.

Ecological validity refers to the nature of the environment, its ecology. Laboratory experiments are often criticized for lacking ecological validity. For example, if Rememberol was shown in a laboratory experiment to improve memory, could this really be generalized to real-life situations? Many students make the mistake of thinking that an evaluation of ecological validity simply includes making a claim as basic as: "This study took place in a lab so it lacks ecological validity." This does *not* demonstrate "critical thinking"; it shows that you know the research method and the term ecological validity.

A thorough evaluation and one that shows excellent critical thinking is providing an explanation for *why* the specific relationship demonstrated in the study might not apply beyond the situation of the study. After all, the reason we use lab experiments is to understand the human behaviour in the real world, so you have to think carefully and show you know the real world applications that studies may or may not apply to.

In my Rememberol example, perhaps taking a test in a laboratory condition where there was no real pressure and there wasn't any consequence riding on the participants' score of the memory test might limit the extent we could apply this to a real life situation. My explanation of this question regarding ecological validity needs to go further and provide an example. For instance, if students are using Rememberol to



Before I could say that my Rememberol experiment would have high internal validity, I would need to make sure that the pill was the only variable affecting my dependent variable (e.g. effectiveness of studying).

study they are likely under a lot of pressure and their scores carry big consequences. Whether or not the stress and anxiety surrounding this situation would alter the effects of Rememberol could be questioned. This evaluation would be made even stronger if I could provide some evidence that suggests stress affects memory.

Here we see the ability to evaluate ecological validity relies on being able to question the extent to which a relationship demonstrated in a study could be applied to a new context, providing an explanation of the relationship between the new context and the characteristics of the study that raise this question. And that's something that's important to note: evaluation can involve asking questions. You don't always need to be making definitive claims like, "*this study lacks ecological validity*." You can phrase it like, "*perhaps we could question the ecological validity of this study because...*" This further shows your ability to think reflectively and in more ways than simply black-and-white.

While ecological validity refers to the environment, **mundane reality** refers to the actual task participants are being asked to perform. In other words, it refers to the extent to which the procedures in the study reflect what would happen in real life. For example, if I tested Rememberol by getting participants to read pages of an encyclopedia and then take a reading comprehension test, this may not be a good indication of what the effects the drug might have in more realistic situations because people don't read the encyclopedia and then take tests. Perhaps this design would lack mundane reality. Whereas, getting them to read a chapter of a novel they have chosen specifically might be a way to make sure the task was more reflective of everyday situations.

Population validity is another way to discuss generalizability of a study that involves very little additional information learnt and can truly demonstrate your critical thinking. Population validity refers to the extent to which the characteristics of the sample are reflective of a wider population or different population that the results might be abstracted to. For example, historically speaking most studies have been conducted in the United States on white, college-aged students. Can relationships demonstrated in these studies be applied to, say, African tribes or South East Asian cultures? Bear in mind that when you are explaining population validity, you need to provide clear and logical reasons for your conclusions. For instance, if you were to argue that the results from one study could not be applied to another specific group, you need to explain why or at least raise questions.

An explanation of population validity requires knowing an important characteristic of the participants in the sample that might affect the extent to which the results can be generalized to another important group, thus raising questions about the validity of the results. But like explaining ecological validity, a strong demonstration of critical thinking requires clear reasons. For example, if you're taking a sample from "healthy" participants and then trying to explain that to a group of people such as war veterans addicted to drugs, what factors about the latter might affect the generalizability of results from the former?

If one study used all females and showed a relationship between testosterone and aggression, could we apply these findings to males as well? Males naturally have higher levels of testosterone and perhaps this has led to other biological differences that might affect the processing of testosterone in the body. Moreover, if the findings of the study were being applied to explain high testosterone levels in prison populations, the all-female participants also raises the question of population validity as a majority of violent criminals (statistically speaking) are males. Thus, the nature of the sample in the study raises questions about the generalizability of the possible applications.

Many students oversimplify their evaluations of studies based on external validity. It is important that you offer well-developed explanations for your evaluations. The "Abstraction Extensions" will help you with this.

You can visit our blog at themantic.education.com to find lots of online resources to help your studies, including examples of evaluations in student essays.

You will learn about a lot of studies that use modern technology. While they can provide some correlations, the nature of these machines means that mundane reality is often questionable.

Critical thinking is not easy - it takes time and serious effort.

(e) Correlation vs. Causation

You'll hopefully learn through the course how and why a study demonstrates a causal relationship or a correlational one. This can be another valuable way to demonstrate your critical thinking about the relationships in studies you are explaining.

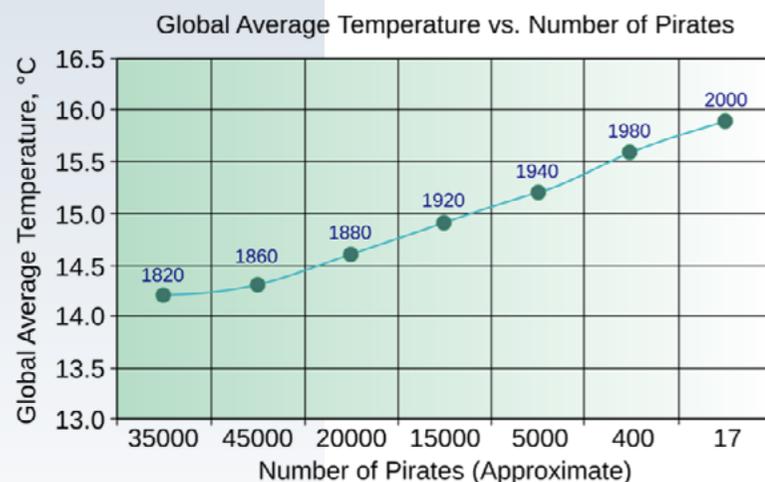
For example, if I used a natural experiment to test Rememberol's effects of different ethnicities, I could explain why this is a correlational relationship. A weak explanation would be something like, "this study used a natural experiment so it can only determine a correlational relationship." Once again, this doesn't demonstrate any reflective thinking, it simply shows you know the terms natural experiment and correlation.

A strong explanation would need to include *why* it's only correlational and offer alternative explanations for the relationship demonstrated. For example, if my study compared students in China and students in the UK, I could explain other possible explanations for why students in the UK achieved higher scores. I would need plausible reasons for my explanation. For example, British schools might have more tests for students based on reading comprehension, so perhaps these results could be explained by the fact that UK students are better at taking these types of tests than Chinese students. Or, the test would have had to be in two different languages so perhaps one test was easier. An even more abstract idea that would really show critical thinking and knowledge of psychological concepts is the fact that reading in Chinese characters might use different areas of the brain than in English because of the nature of their scripts (Chinese is based on characters, not letters), and so maybe Rememberol works better on one part of the brain than another.

It might seem like trying to take a short-cut by avoiding reliability and internal validity. However, this limited focus is necessary due to the nature of the IB Psychology course and its assessments: you are expected to develop conceptual understanding of such a wide range of relationships. The studies need to be applied first and foremost to develop these understandings. Secondly, many essay questions require you to "discuss" relationships or to determine "to what extent" one variable influences another, and in these cases there's a very good chance you won't need to evaluate the research. Furthermore, in questions where you discuss or contrast ethical considerations, for example, an evaluation of the research methodology in terms of the conclusions they drew between variables becomes rather redundant.

But this doesn't mean that aiming to develop evaluative skills in psychology isn't important. Far from it! Being able to critically assess information you are given and how you use it is an absolutely vital life skill and another underlying goal of this course. You absolutely *must* be working conscientiously to develop your thinking skills so by at least the second or third unit of the course you are able to know a study or theory, explain it and then question it! If you can't learn to question the validity of information you receive, you run the risk of going through life an open sponge ready to be influenced by any piece of manipulative media that floats your way.

More terms and concepts that are useful to know when evaluating studies



The above is a common example used to show correlation vs. causation. Has the decrease in pirates caused an increase in temperature?

are explained in the "Abstraction Extensions" included in each section of the text. The exam preparation materials also include more examples of evaluating studies and theories in exam answers. For most students in their first few weeks or months of studying IB Psychology, it might be difficult to evaluate studies because it takes time to become fluent in reading, analyzing and understanding them first. As the course progresses and you become more fluent in understanding studies you should be working more and more on developing your critical and abstract thinking skills.

Many students make the mistake of blindly memorizing evaluations of studies and then "dumping" them in their answers. However, through the thematic course structure you are going to learn about studies and the relationships they demonstrate in a way that will enable you to apply them to *multiple* possible questions to explain multiple possible relationships. The relationship you are applying the study to will affect *how* you evaluate the study. Moreover, the course and exams have been designed so that it makes it extremely difficult, nearly impossible, to memorize "critical thinking" and do well. There are simply too many possible exam questions that might be asked.

To summarize, the following questions can be used as guides when evaluating studies. To what extent...

- ...can the results be generalized from the study to other contexts based on methodology?
- ...are there alternative explanations for the results and/or conclusions in the study?
- ...is there data from other sources that support or contradict the findings in the study?

(f) Evaluating Theories

It is just as important that you can critically assess theories as you can psychological studies. This is why it can be useful to begin your study of a theory by reminding yourself that it is a theory and it's up to you to determine to what extent you think the theory is valid.

Some of the most important evidence in assessing psychological theories comes from empirical studies. Therefore, when evaluating the validity of a theory (*after* you've understood what the theory is describing and explaining) you should determine to what extent the theory can be supported by evidence that comes from credible studies.

Another way to critique a theory is to determine the extent to which it can be applied to explain psychological phenomena. For instance, social identity theory can be used to explain a range of phenomena, such as stereotyping, conformity, prejudice and discrimination. Being able to apply theories to a range of behaviours is an important cognitive skill to develop and can be very useful when writing essay answers. If you are asked about a particular behaviour, for instance conformity or stereotyping, you could apply the social cognitive and/or social identity theory to these questions. The ability to use studies and theories in multiple different explanations is what is going to help you reduce the amount of content you need to memorise, which gives you more time to develop understanding and deeper critical thinking skills.

Similarly, one way of critiquing a theory is through explaining how a study contradicts that theory. Perhaps you can find a study that actually gives evidence that goes against the major claims of the theory. For instance, some theories were developed before the invention of brain imaging technology so new information we can learn

The first step in evaluating a theory is usually finding at least one study that can demonstrate the same relationship that the theory posits. You can then go further by evaluating the supporting evidence or by finding contradictory evidence.

Many theories of cognitive processes were devised before the invention of technology like the MRI and fMRI. These new methods can offer supporting and contradictory evidence for psychological theories.

about the brain can actually be used to critique some of these theories that were developed without the help of this technology. For example, the multi-store model of memory was developed in the 1960s. Results from studies using fMRI and other brain scanning technology may be used to contradict or support the memory processes that this study attempts to model.

Another way of critiquing the theory is to determine the extent to which the psychological phenomenon being explained by theory could be explained using an alternative explanation. A good way to begin thinking about this is to identify which approach is at the core of the theory (i.e. biological, cognitive or sociocultural). For instance, social identity theory ignores biological aspects of group behaviour, but while it attempts to describe and explain how belonging to a group can influence behaviour, you could provide alternative explanations for the behaviour in group situations based on biological factors.

One final way of evaluating a theory is to determine the extent to which it accurately describes and/or explains the phenomena in question. For example, the multi-store model of memory attempts to describe the process of memory formation and explain how attentional processes affect this formation. But does this apply to *all* types of memory? Perhaps there are some memories, such as fear conditioned memories, that can't be explained using this model.

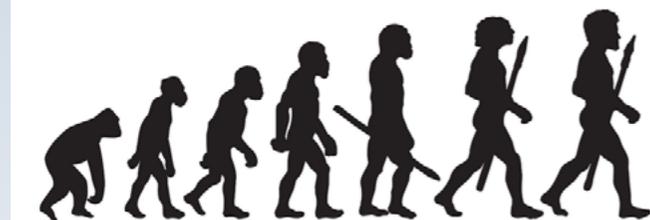
To summarise, the following guiding questions can help you think critically about theories. To what extent...

- ...is the theory supported and/or contradicted by studies?
- ...can the theory be applied to explain phenomena?
- ...are there alternative explanations for the phenomena that the theory attempts to explain?

One aim of this textbook is to get you to develop your thinking skills to a point where you can come up with insightful, well-developed and clearly explained critical thinking points in your exams, including some that you've never thought of *before*. This is the same goal shared by the IB examiners: it's *not* hoped that you will pre-prepare your critical thinking points before exam day. This is why there are so many possible exam questions: it's hoped that you will be able to demonstrate novel critical thinking in the exam situation. If you were able to pre-prepare all your arguments, then the exams wouldn't be an accurate assessment of your critical thinking ability because there'd be no way for examiners to discern if the thoughts were your own, or if they were simply memorizations of someone

else's thoughts. The exams are designed so an accurate assessment can be made as to the extent to which you have demonstrated an ability to demonstrate thinking skills that you are likely to be able to use *beyond* the IB programme.

There is more information on how to demonstrate "critical thinking" in the Exam Preparation chapter. The strongest message I want you to take away from this is that learning how to *think* is absolutely vital in this course if you're hoping to do well.



Charles Darwin's Theory of Evolution has considerable evidence to support it. You will learn about lots of psychological theories and you will need to consider evidence that supports and/or challenges these theories.

This book follows Themantic Education's philosophy - education is about preparing you for success in life, not just about success in exams.

1.5 IB Psychology Overview

What are the requirements of the IB Psychology course?

(a) Assessments

In IB Psychology, HL students have four major assessments whereas SL students have three.

Assessment	Time	Weighting	
		SL	HL
Internal Assessment (IA)	20 hrs	25%	20%
Paper 1	2 hrs	50%	40%
Paper 2	1 hr (SL) 2 hrs (HL)	25%	20%
Paper 3 (HL)	1 hr	-	20%

There is a lot more detail about these assessments in other relevant chapters. A useful strategy to make sure you're well-prepared for your exams is to regularly re-read the reference materials included in the Introduction and Exam Preparation chapters so you can be making sure that you are understanding how and why what you're learning is relevant for the exams.

Do note that the structure of the course is such that you don't need to revise *everything* for the exams. You will have a lot of choice as to what you want to revise. For example, by the end of the course you will have multiple ways to discuss evolution and behaviour. You can wait until all units have finished to decide which evolutionary explanation of behaviour you want to focus on. This means that throughout the course you can worry less about what you're going to write about in exams, and simply enjoy the process of studying psychology - leave most of your exam preparation for nearer the end of the course. The benefit of the themantic approach is that you should have more revision time to do this because overlaps can be found between the core and options.

(b) The “Core”: Three Approaches to Psychology

The IB Psychology course identifies three ways of approaching the study of psychology. These are also known as the “core”. The three approaches are:

- The Biological Approach
- The Cognitive Approach
- The Sociocultural Approach

The Biological Approach

This approach is designed to get you to understand how physiological factors can affect a range of mental processes and behaviours. Biological factors, including hormones, genetics, and brain function, have all been shown to affect our behaviour. Moreover, the study of neuroplasticity shows how in fact our behaviour can affect our brain, so the relationship can work in the opposite direct, too.

The Cognitive Approach

Not surprisingly, this approach focuses on developing an understanding of the cognitive processing side of psychology. You’ll learn about theories of memory and how a range of factors can influence our cognition.

The Sociocultural Approach

The primary focus of the topics within this approach are designed to get you to understand how our thinking and behavior can be influenced by social and cultural factors.

You can see from the following table, that many of the topics from the three approaches are covered in at least two different units. This takes much of the pressure of preparation for the exams because what you will learn in one unit might not be used in the exams. For example, if you didn’t quite understand the localization of brain function topic when studying criminology, you get another chance when studying PTSD.

As the goal is to develop conceptual understandings of these areas of study and their relevant topics, you’ll hopefully see why there’s no reason we can’t study them in any order we like!

Approach	Topic	Content	Covered In...
Biological	The Brain and Behaviour	Technology in Research	<ul style="list-style-type: none"> • Criminology • Social Influence • PTSD
		Localization of brain function	<ul style="list-style-type: none"> • Criminology • Social Influence • PTSD
		Neuroplasticity	<ul style="list-style-type: none"> • Criminology • PTSD
		Neurotransmission	<ul style="list-style-type: none"> • Criminology • PTSD
	Hormones and Behaviour	Hormones	<ul style="list-style-type: none"> • Criminology • Love and Marriage
		Pheromones	<ul style="list-style-type: none"> • Love and Marriage
	Genetics and Behaviour	Genetics	<ul style="list-style-type: none"> • Criminology
Evolution		<ul style="list-style-type: none"> • Criminology • Love and Marriage 	
Cognitive	Cognitive Processing	Models of Memory	<ul style="list-style-type: none"> • PTSD
		Schema Theory	<ul style="list-style-type: none"> • Social Influence
		Thinking and decision making	<ul style="list-style-type: none"> • Criminology
	Reliability of Cognitive Processing	Reconstructive memory	<ul style="list-style-type: none"> • Social Influence
		Cognitive Bias	<ul style="list-style-type: none"> • PTSD • Social Influence
	Emotion and Cognition	The influence of emotion on other cognitive processes	<ul style="list-style-type: none"> • Criminology • PTSD
Sociocultural	The Individual and the Group	Social Identity Theory	<ul style="list-style-type: none"> • Social Influence
		Social Cognitive Theory	<ul style="list-style-type: none"> • Criminology
		Stereotypes	<ul style="list-style-type: none"> • Social Influence
	Cultural Origins of Behaviour and Cognition	Culture	<ul style="list-style-type: none"> • Criminology • Love and Marriage • Social Influence • PTSD
		Cultural Dimension	<ul style="list-style-type: none"> • Social Influence • Love and Marriage
	Cultural Influences on Individual Attitudes, Identity and Behaviours	Enculturation	<ul style="list-style-type: none"> • Social Influence
		Acculturation	<ul style="list-style-type: none"> • Social Influence
Ethical Considerations and Research Methods	For all topics and areas of study in the three approaches you need to be aware of how and why research methodology (e.g. natural experiment, case study, etc.) and ethical considerations (e.g. informed consent, anonymity) are related to those particular areas of study.		

This text combines all three approaches in understanding specific behaviours. This is designed to give you a more holistic understanding of the complex interaction of variables involved in human behaviour.

A good way to revise at the end of the course is to sort out all the studies into the different approaches. You will find that some studies form part of two or even all three approaches.

(c) Conceptual Understandings

Throughout this chapter I've been using a term that you might not yet understand: **conceptual understanding**. A concept is an **abstract idea**, something that doesn't exist in the concrete. A conceptual understanding, therefore, is an understanding of an abstract idea and in psychology this often refers to relationships. The reason why it's valuable to develop this skill is that because the ideas are abstract, they have the power to be applied in many ways to the different areas. This increases the possibility of *actually* using what you learn in school.

For example, *causation* is an abstract idea. If you can understand the idea of causation in psychology, it's hoped that you could abstract this understanding and think about it in relation to your other subjects (e.g. causes of war in History). This is the goal of TOK: to get you making connections between ideas across subjects so you can develop your understanding of abstract ideas.

Developing these understandings of abstract concepts begins with concrete learning. So acquiring an understanding of key *psychological* concepts is one major goal of this course. From the earlier table that outlines the topic you know generally what it is you need to know about. But you need to go further than just knowing about these topics and areas of study.

In psychology, you need to develop knowledge of, and understanding of significant relationships between the following:

- Behaviours
- Cognitive processes
- Variables
- Research Methods
- Ethical considerations

The examination questions are designed to assess your conceptual understanding of these signification relationships. The topics provide you with an indication of what you need to understand. The following table will also help guide your learning. The guiding questions for each section in the text are not necessarily the overarching conceptual understanding that you need to develop by the *end* of the course, but they do help provide you with an understanding that helps lead you towards developing that bigger understanding.

Developing an understanding requires you to figure out how things are significantly related in response to a question or problem. The more abstract these relationships become, the broader the concept that you're understanding becomes.

For example, you will learn about how levels of testosterone might increase aggression. Then, when you compare this concept with other hormones and their effect on behaviour, like the role of cortisol on memory, you can develop an understanding that "levels of hormones can influence behaviour". Then, when you connect this with other studies investigating biological variables, you will develop an understanding that "biological factors can influence our behaviour", and voila! You've developed a key conceptual understanding of the biological approach to studying psychology.

(d) Concepts in the Core

The following tables provide insights into the conceptual understandings you will develop by the end of this course. These are what the examination questions in Paper One are based on and what you need to demonstrate. In fact, that's one big thing examiners are looking for as they read your answers: they are look for evidence that shows you have grasped and comprehend an important concept in this course. The exam preparation information will show you exactly how to demonstrate your understanding.

Underlying all of these is an understanding of how research methods and ethics relate to these approaches, areas of study, and topics. The ability to reflect upon these understandings and the evidence upon which they're based is another underlying goal for the course.

Conceptual understanding in IB Psychology is about understanding the interactions between variables, cognitive processes and behaviours. This text is designed to help you move from concrete knowledge to comprehending increasingly abstract ideas about these complex interactions.

Conceptual Understandings in the Biological Approach

Biological factors can influence, and are influenced by, our mental processes and behaviour.

Functioning of the brain can influence our behaviour and vice-versa.			Levels of hormones can influence our behaviour, and vice-versa.		Genetics can influence our behaviour and vice-versa.	
Levels of neurotransmitters can influence behaviour	Different parts of the brain have different functions	When studying the brain, particular techniques are used.	Levels of hormones can influence behaviour	Pheromone excretion may influence behaviour	Genetics can influence our biology, which influences our behaviour	Evolutionary processes can influence our behaviour
e.g. decreases in serotonin may influence aggression	e.g. the hippocampus plays a role in memory formation	e.g. MRIs enable the researcher to measure changes in brain structure	e.g. increases in testosterone may lead to aggressive reactions	e.g. pheromones may give off signals of strength and health, influencing attraction.	e.g. the presence of a variation in the MAOA may affect violence.	e.g. the innate desire to have healthy babies may influence whom we're attracted to

All of your IB courses encourage the development of conceptual understanding. This means doing more than just focusing on memorizing as much information as possible.

Psychology is the study of relationships. If you simply work hard to understanding the relationships you're introduced to throughout this course, you will be developing conceptual understanding.

Conceptual Understandings in the Cognitive Approach

Cognition influences, and can be influenced by, a number of processes and factors.

Cognitive processes can influence one-another, as well as being influenced by external factors.		Many factors may influence the reliability of our cognitive processes		Emotion can influence our cognitive processes	
MSM and WMM provide explanations for how internal processes affect memory.	Schema theory describes how our mind organizes information. This can influence our behaviour and other cognitive processes.	Thinking and decision making can influence our behaviour.	Our memory may not always be reliable, and could be affected by various processes and factors.	Cognitive biases may occur in our thinking and decision making due to a range of factors.	Emotion can influence our memory, thinking and decision making.
e.g. the MSM explains how attention processes influences the formation of short term and long term memory formation.	e.g. Stereotypes may be a result of forming a schema of a particular group of people.	e.g. Inability to use System two processing may lead to rash decisions and impulsive actions.	e.g. schema processing may influence how well we remember details of certain people or events.	e.g. confirmation bias may occur to influence our self-esteem and increase positive distinctiveness between groups.	e.g. fear condition is a type of learning and is influenced by feelings of emotion and the biological factors associated with fear.

Conceptual Understandings in the Sociocultural Approach

Social and cultural factors can influence, and our influenced by, our cognition and behaviour.

Individuals can influence, and are influenced by, the group.		Culture can affect our mental processes and behaviour.		Cultural influences can affect identity, attitudes, and behaviour.
Belonging to a group can influence our thinking and behaviour (SIT).	Our environment, behaviour and individual characteristics all influence one another (SCT).	Our way of thinking about others (stereotypes) can be influenced by social, biological and cognitive factors.	Cultural values can influence our cognition and behaviour.	People may change their ways of thinking and/or their behaviour based on their cultural environment (i.e. being acculturated or enculturated).
e.g. when we belong to a group we may look negatively towards out-groups, which can explain negative stereotypes.	We can learn attitudes and values by observing others, which can affect our behaviour and our biology (e.g. culture of honour).	e.g. Stereotypes may form as a result of schema processes and/or the influence of group belonging.	e.g. our cultural values regarding thinking about our family before ourselves may influence what we look for in a potential mate.	e.g. Sudanese refugees who arrived in the US without parents were able to combine aspects of their home culture and positive aspects of the US culture.

(e) HL Extensions

For each of the approaches to understanding psychology, HL students have been allocated additional material to study. However, these are general themes that are covered in the core topics anyway, so new studies and information don't always need to be learned. The HL Extension Topics identifies exactly what these themes are and will help HL students focus on developing their understanding of the nature and importance of these themes. For example, the theme for the biological approach is "the role of animal research in understanding human behaviour." Through Criminology there are numerous animal studies included and so HL students will already know about how and why these studies were used, so the HL extension chapter just allows HL students some time to focus on these themes specifically and to solidify conceptual understandings. But new studies and ideas will be introduced to further your understanding of psychology. The concepts in these extensions are often more challenging than in the core in order to challenge HL students.

So the three themes are:

- Biological Approach: "the role of animal research in understanding human behaviour"
- Cognitive Approach: "cognitive processing in the digital world"
- Sociocultural Approach: "the influence of globalization on individual attitudes, identities and behaviour."

These may seem daunting right now, but they are not as confusing as they sound.

Two possible ways these HL extension topics may be addressed are:

- As a separate unit near the end of the course
- As the course progresses

Option (a) is recommended because it may prove easier to identify and understand these themes from topics and studies after they've been covered in the context of other units. However, your school's scheduling might mean that this is not always possible and so they can be taught as the course progresses. For instance, you could learn about animal research alongside criminology as there are many animal studies in this unit, and cognitive processing alongside social influence as the use of technology is often influenced by social factors. Your teacher will decide how you will approach these HL extension topics.

There are pros and cons to either approach. This book has tried to be structured in a way so either approach would be equally suited. The Biological Approach extensions are in line with Criminology, Sociocultural with Social Influence and Cognitive with PTSD. You can see an overview of the topics in the HL Extension chapter.

HL students have been given 30 hours to cover extensions to the core. However, this entire time may not be necessary and could be spent in other ways.

(f) The “Options”

There are four options topics available in IB Psychology. SL students are recommended to study one option and HL students need to study two.

The two options topics that are the core focus in this themantic course are Abnormal Psychology and Human Relationships. These options topics are designed to teach you how biological, cognitive, social and cultural factors can all be influential in human behaviour. The PTSD unit is focused on addressing the topics in Abnormal Psychology, while the key concepts from the Human Relationships topic are addressed primarily in Social Influence and Love and Marriage.

When studying Human Relationships you will learn about how multiple factors may affect different types of interpersonal and inter-group relationships. For instance, you will learn about biological, cognitive and sociocultural factors that may influence attraction, marriage, conflict and altruism (helping others).

The theory behind the structure of the IB Psychology course is that you should start by developing an understanding of the individual approaches in the core, and this will prepare you for understanding the options topics. However, in reality this doesn't really work because it limits the time you have to develop an understanding that is comprehensive enough to do well in all aspects of both exam Papers One and Two.

Because you're studying psychology themantically, which means each chapter includes a combination of the three approaches and aspects of the options, your exam revision is very important. You will find that you will have a lot of choice as to what you write about in the exams. The exams are structured according to the approaches and the options, so The Exam Preparation materials (and the accompanying workbook) will help you identify what aspects of the course you'll be able to apply to each possible exam question.

Another reason why you don't need to study the options and core separately is because the ultimate goal is to develop the necessary conceptual understandings and these can be developed in a number of ways. For example, learning about biological origins and treatments of PTSD symptoms contributes to your understanding of how biological factors can influence behaviour.

By studying psychology through the narrow lens of individual approaches, you may only get a limited understanding of the complex interactions of variables involved in human behaviour and mental processes. This is why it makes sense to combine the options with the core.

The following table provides you with an overview of the Abnormal and Human Relationships topics.

Option	Topic	Content	Covered In...
Psychology of Human Relationships	Personal Relationships	Formation of personal relationships	Love and Marriage
		Role of communication	Love and Marriage
		Explanations for why relationships change or end	Love and Marriage
	Group Dynamics	Co-operation and competition	Social Influence Criminology
		Prejudice and discrimination	Social influence
		Origins of conflict and conflict resolution	Social influence Criminology
	Social Responsibility	Bystanderism	Social Influence
		Prosocial behaviour	Social influence
		Promoting prosocial behaviour	Social Influence
Abnormal Psychology <i>While the PTSD unit covers this option, much of the concepts build upon learning from previous units (e.g. the role of the amygdala in the stress response, the role of the PFC in cognition and neuroplasticity).</i>	Factors Influencing Diagnosis	Normality versus abnormality	PTSD
		Classification Systems	PTSD
		The role of clinical biases in diagnosis	PTSD
		Validity and reliability of diagnosis	PTSD
	Etiology of Abnormal Psychology	Explanations for disorders	PTSD
		Prevalence rates and disorders	PTSD
	Treatment of Disorders	Biological Treatments	PTSD
		Psychological Treatments	PTSD
		The role of culture in treatment	PTSD
		Assessing the effectiveness of treatment(s)	PTSD

As with the core, the themes of understanding approaches to research and ethical considerations are important to understand for each of the topics in the options. In addition, understanding the extent to which these topics relate to biology, cognition and socio-cultural factors is also important.

You may be asked an essay on any one of these topics, so straight away you can see that it would be nearly impossible to develop an understanding that is detailed enough to write an essay about each of these in the time the IB allows (20 hours) if you were to try to study this course topic by topic. For abnormal psychology, there are 8 topics in 20 hours, which would leave you with just over two hours to develop knowledge of, and conceptual understandings regarding:

- The terminology and key concepts
- The relevant research (studies and/or theories)
- An evaluation of the research methods
- Relevant ethical considerations
- Relationships with biological, cognitive and sociocultural approaches

This is another deliberate ploy by the designers of the IB course to make it almost impossible to succeed by memorization alone, which aids major goals of the course: to develop understanding and critical thinking skills that require more than memorization of copious amounts of facts and details. In order to be well-prepared for the exams you simply must develop an in-depth understanding of key concepts in psychology.

Material that supports the other options will be published separately.

Be sure to subscribe to our free blog for revision resources. You can also use our text *IB Psychology: A Revision Guide* for exam preparation.

(g) Concepts in the Options

As with the core, the options topics and their corresponding exam (Paper Two) require you to develop and convey conceptual understandings of a range of topics. This is made a little easier by the fact that the exam will probably have one question from each of the areas of study, so you can choose an area of study that you want to excel at and focus your revision and exam preparation on that particular area of study.

Conceptual Understandings in Human Relationships						
Human relationships are influenced by biological, cognitive and sociocultural factors.						
Personal relationships can be influenced by a range of factors.						
The formation of personal relationships can be influenced by a range of factors.	Communication can influence personal relationships.	Relationships may change or end based on a number of factors.	Co-operation and competition are influenced by many factors.	Prejudice and discrimination may be affected by, and affect, many factors.	Conflict may be the result of a number of factors, and strategies can be used to resolve conflict.	Strategies can be used to promote prosocial behaviour.
e.g. cultural values may affect the type of person we want to marry.	e.g. Constant negative communication (e.g. criticism) can affect relationships, even at a biological level.	e.g. Marriage satisfaction is affected by the presence of negative communication styles.	e.g. Competition between groups for resources can increase conflict.	e.g. the belonging to a group and desire to increase self-esteem may increase feelings of prejudice and acts of discrimination.	e.g. competition for resources can cause conflict but working together can resolve it.	e.g. Jigsaw activities in classroom can increase the likelihood kids will help one another.
An individual's feelings of social responsibility may be influenced by a range of factors.						
Bystanderism may be influenced by a range of factors.		Prosocial behaviour may be influenced by a range of factors.		Disorders can be treated psychologically.		
e.g. The presence of others and their actions may affect levels of bystanderism.		e.g. Cultural values may affect how inclined someone might be to help someone else.		e.g. Drug therapy and medication could be used to treat symptoms of PTSD.		

Conceptual Understandings in Abnormal Psychology

The diagnosis and treatment of psychological disorders requires consideration of multiple variables

Diagnosis of disorders can be influenced by a range of factors.						Treatment of disorders needs to consider multiple factors and approaches.			
There are multiple explanations for the origins of disorders, their symptoms and their prevalence.									
Disorders are difficult to define.	Classification systems help define disorders, but there are issues.	Clinical bias can influence diagnosis.	Validity and reliability of diagnosis can vary.	There are multiple possible explanations for psychological disorders.	Symptoms and prevalence rates can vary across cultures and genders.	Disorders can be treated biologically.	Disorders can be treated psychologically.	Culture influences treatment of disorders.	Treatments can vary in their effectiveness.
e.g. It's not always clear what a maladaptive behaviour is.	e.g. The DSM may be biased towards Western cultures.	e.g. confirmation bias may influence validity of diagnosis.	e.g. Distinguishing what is normal shock and what is PTSD may be difficult, affecting diagnosis.	e.g. PTSD may be a result of brain dysfunction and/or sociocultural environmental factors.	e.g. Veterans from different ethnic groups may experience different rates of PTSD for a number of reasons.	e.g. Drug therapy and medication could be used to treat symptoms of PTSD.	e.g. Cognitive-behaviour therapy could help treat PTSD.	e.g. A veteran's cultural background may influence treatment.	e.g. Drug therapy may only target symptoms, whereas psychological therapy could target underlying neurological origins.

(h) Research Methodology

There are two underlying themes that thread throughout the approaches and the options: **research methods** and **ethical considerations**. These are important to understand and are addressed fully in later chapters.

If research is how we know what we know in psychology, critically assessing the nature and quality of this research is really important. There are two distinct types of research methodology in psychology:

- I. Quantitative
- II. Qualitative

Quantitative research is research that gathers numerical data. That is to say, it deals with numbers and figures. The most common of this type of research is experimental research, which deals in independent and dependent variables. You will learn about laboratory, natural and field experiments in the chapter on quantitative methods. It will be easier to understand these methods after you have had decent exposure to a range of studies, which is why it's recommend (if possible) to learn about these later in the course after you have a firm knowledge base on which to build.

The following are the topics involved in studying **quantitative research**:

Quantitative Research		
Quantitative Research Designs	Experiments	
	Field Experiments	
	Quasi Experiments	
	Natural Experiment	
Elements of Quantitative Methods	Correlational Research	
	Research Design	Matched pairs
		Independent samples
		Repeated measures
	Hypotheses	Null
		Experimental
	Independent and Dependent Variables	
Sampling Techniques	Random	
	Convenience/opportunity Volunteer/self-selected	
Controls		
Ethical Considerations		
Analyzing Data	Data Presentation	
	Statistics	Descriptive Inferential
Evaluating Research	Reliability	Test-retest reliability
	External Validity	Ecological validity
		Population validity
	Internal validity	Demand characteristics
Inter-rater reliability		
Drawing Conclusions	Correlation and causation	
	Replication	
	Generalization	
	Triangulation	Researcher triangulation
		Methodological triangulation Data triangulation

Because humans are so complex, many modern psychologists believe that it's not always beneficial to reduce our behaviour and cognition down to numbers, so they take a qualitative approach. This approach involves gathering qualitative data, which means words and descriptions, *not* numbers.

The following are topics involved in studying **qualitative research**:

Qualitative Research		
Quantitative Research Designs	Case Studies	
	Observations	Covert and Overt
		Participant and non-participant
	Interviews	Unstructured
Semi-structured		
Focus group		
Elements of Quantitative Methods	Sampling Techniques	Purposive Snowball
	Ethical Considerations	
Analyzing Data	Inductive content analysis (thematic analysis)	
Evaluating Research	Credibility	
Drawing Conclusions	Transferability	
	Triangulation	Researcher triangulation
		Methodological triangulation
Data triangulation		

Both SL and HL students will learn about experimental methodology because it's essential for completion of the internal assessment. Understanding methodology may also be required in Paper One and/or Two.

Only HL students will study both qualitative *and* quantitative methodology in-depth, as either of these approaches to studying psychology may be the basis of Paper 3, which is the HL only exam.

You will see that there are a lot of new terms for you to remember. Trying to learn these terms without context (i.e. without developing detailed knowledge of a range of studies first) is difficult, which is why it's recommended to approach the understanding of these new terms and concepts in the following ways:

- (a) Read the **Abstraction Extensions** in each section to gradually acquire an understanding of these terms and concepts.
- (b) Read the additional explanations and links included at the end of each topic to help build your understanding of the connections between research methods, ethics and areas of study.
- (c) Study these terms, concepts and methods *after* first completing one or more units of study (e.g. Criminology, Social Influence, etc.) so you have a solid foundation of research knowledge to make connections with.

(i) Ethical Considerations

Ethics are closely related to morals and the difference between ethics and morals is debatable and highly subjective, so note that the explanation of ethics here is my understanding of ethics and this is open to being challenged.

Morals typically refer to an inherent belief about what is right and wrong. People talk about their “moral compass” which refers to their ability to be directed by their understanding of the right and wrong ways to think and act. You may discuss morality in your TOK classes.

Ethics are closely related to morals in that they are related to appropriate and inappropriate ways of behaving. Where ethics often differ, however, is that they are connected with a particular group, field or situation. Many professions have particular ethical standards and codes that they are required to follow. For instance, if a Doctor went on a date with her patient many people wouldn't consider this “immoral”, but they might consider this “unethical.”

Let's look at the words of someone who is an expert in the field of ethics, the Dalai Lama. He believes that “establishing binding ethical principles is possible when we take as our starting point the observation that we all desire happiness and not to suffer.” (Ancient Wisdom, Modern World). It is this idea of preventing physical suffering, or harm, or any form of psychological stress or discomfort that lies at the heart of ethics in psychological research. Many students make the mistake of thinking that understanding ethical considerations in psychology involves making judgements about if research is ethical or not. You are not required, nor encouraged, to make such black-and-white judgments. You need to learn the guidelines that are in place and how they relate to particular studies and areas of study.

But beyond that it is hoped you will develop a deeper understanding of how ethical considerations are simply that: to be considered. What is ethical and what is not is not always black and white. Moreover, sometimes harm or suffering is required in research to get valid results. Thus, considering the balance between ethics and research is a difficult one, and this is a relationship that you should be contemplating deeply throughout the course.

Ethical guidelines have been put in place to guide psychologists in their design of studies using animals and humans. Before conducting research, psychologists often need to present their research proposal to an ethics review committee who will approve or decline their research based on ethical grounds. They make judgments, but you don't need to.

There are numerous different ethical guidelines that are different depending on the psychological association the researchers (i.e. psychologists) are registered with. Common ethical guidelines for researching using humans are:

- **Informed Consent**
This involves having participants agree to participate (consent) in the study beforehand. They need to be provided some information regarding the nature of the study (they're informed). They can provide consent through checking an online form, signing a paper, verbal agreement, etc. Retrospective consent is a particular ethical consideration that replaces informed consent in covert observations: it is when consent to analyze data and publish findings is gathered after the study.
- **Considerations regarding deception**
To deceive means to lead someone to believe something that's not true.

This can cause psychological damage, but is sometimes necessary in psychological research, so researchers may need to carefully consider issues involved in deception, such as justification of the deception and the extent to which it will cause harm.

- **Justification**
Sometimes inducing harm, stress or other undesirable effects is essential in research studies. Where this is the case, there must be appropriate justification for such measures, as well as measures taken after the study to ensure that there are no long-term negative effects as a result of the research.
- **The right to withdraw**
Participants are given the right to stop participating in the study at any time.
- **Debriefing**
Providing participants with all the details of the study after it has finished, including the aims and results and possibly even the significance of the findings.
- **Anonymity**
To be anonymous means not having your name known. In studies the names of participants are not revealed (i.e. participants are anonymous) to protect their privacy and to avoid embarrassment or other potential issues.
- **Approval from an ethics review board**
Modern psychological research is subjected to review by a group of members of the relevant psychological organisation (e.g. American Psychological Association for studies in America, or the Chinese Psychological Society in China). This review board will consider the proposed research and determine if it meets ethical standards and can be approved.

You will learn about many studies that involve the use of animals. Naturally, the ethical considerations surrounding the use of animals are slightly different. For instance, it's impossible to get informed consent from a rat and a debriefing of the results of an autopsy on a rabbit would be a rather one-sided (and pointless) discussion.

HL students may be asked about the ethics of animal research as part of their extension material for the biological approach. Here are some common ethical considerations regarding animal research:

- **Animal welfare**
Animal welfare should be a primary concern for researchers who are using animals in their studies.
Animal welfare includes avoiding any unnecessary harm or suffering. If it is expected that animals may experience long-term suffering as a result of an experiment, euthanization needs to be considered.
- **Justification**
Where there is harm, stress or suffering inflicted upon an animal, just as with human research there should be sufficient justification for this to occur. For example, if a study is being carried out that involves stress and physical injury to animals just to replicate findings that have been replicated many times, is this sufficient justification?

Another interesting ethical consideration surrounding animal research is that regarding the cognitive capabilities of animals and whether or not that affects their treatment. For example, should the same set of rules be applied to sea snails as to chimpanzees? Should all animals have the same set of considerations, or does the ability for some animals to experience greater levels of consciousness affect how we should treat them? This is perhaps beyond the scope of our studies, but it's an interesting consideration nonetheless.

Ethical considerations in psychology are important to ensure that research does not inflict physical or psychological damage on participants.

It's important that you know the ethical considerations. The next step is being able to explain why they're relevant in particular areas of study in psychology.

Conclusion

“Why am I learning this?”

This is the most powerful question you can be asking yourself as you are studying IB Psychology. All the information, materials and resources provided in this book are designed to have an impact on your learning that is going to be meaningful in some way. The more you can figure out for yourself the relevance, significance and importance of what you're learning, the deeper your understanding of psychology will become.

As you begin this course, much of this information may not make too much sense as you have not had enough experience with the course. However, as you practice writing exam style questions and you become more familiar with the study of Psychology, it would be wise to regularly refer back to the information provided in this introductory chapter.

It's important to try to find a nice balance between learning in an authentic way and learning in preparation for assessments. It is hoped that the concepts and material included in this text will provide you with an interesting variety of topics and ideas so that you will naturally enjoy the study of Psychology and get a little lost in the subject. It's also a reality that students, teachers, and parents are very aware of examination and IB assessment requirements, as these are important for the next steps in your lives. Thus, your approach to this course will hopefully aim to strike a balance between learning because it's interesting as well as being well-prepared to exceed your potential.

The text has been carefully designed so everything you would need to know in order to succeed in the exams has been included. However, if you are curious and/or want to seek out more information, especially about the studies that have been explained and referenced, you are encouraged to do so.

It's important to remember that this text is flexible and is not prescriptive by any means. I have included information in a sequence that makes sense to me, but your teacher may decide that they have an even better way of teaching the course. Similarly, your teacher might have better and more relevant topics to study than those that I have included. As always, this text is a "student's guide" and not a "student's bible." You

Remember that school isn't just about preparing you to be successful in tests and exams; it's about preparing you to be successful in *life*.



Chapter 2

Criminology

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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



Charles Whitman. (Image from wikimedia commons)

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.

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

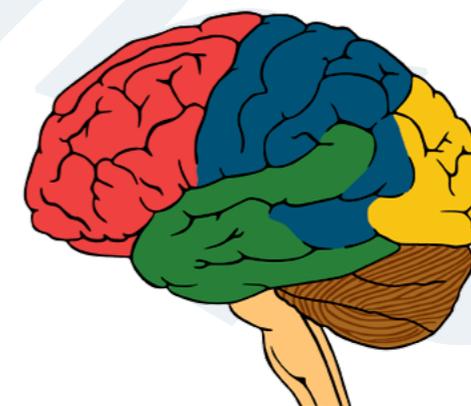
In this first introduction to understanding violent crime, we're going to focus on the most important organ in our bodies – the brain. As you'll remember from the introduction, it's always important that you analyze the evidence when making conclusions about behaviour. Remember that understanding human 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.

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**.

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



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).

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

Sample

– 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**.

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?”

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.



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

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

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.

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

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

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



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.

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.

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

- Ethics
- Research Methods
- Localization of Brain Function
- Origins of conflict

Practice Exam Questions

- Outline one method used in a study related to localization of brain function.
- Evaluate one origin of conflict.
- Discuss ethical considerations related to studying the brain and behaviour.

Research Methods

When studying the relationship between brain damage and behaviour researchers may use **correlational studies**. In Grafman et al.'s study the two variables being correlated were the size of the lesion in the brain and the extent of aggressive behaviour. Conducting correlational analyses and finding correlational coefficients can enable conclusions to be drawn between naturally occurring brain damage and changes in behaviour.

Ethical Considerations

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 The Brain and Decision Making

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

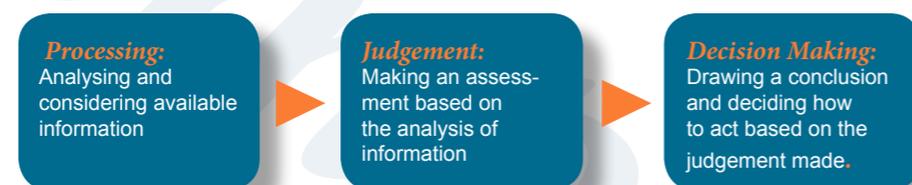


If you were a young kid, do you think you'd be able to wait ten minutes for another marshmallow? Try to imagine what kinds of thoughts would be going through a child's head as they wrestle with this problem.

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).



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."

Kahneman (2003, 2011) has proposed a **dual process model of thinking** to explain two types of processing involved when making a decision.

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

System One	System Two
<ul style="list-style-type: none"> • Fast • Nonconscious • Automatic • Based on experiences 	<ul style="list-style-type: none"> • 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

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

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. You might also be interested to read Danile Kahneman's book, *Thinking, Fast and Slow*.

(c) PFC Damage and Decision Making

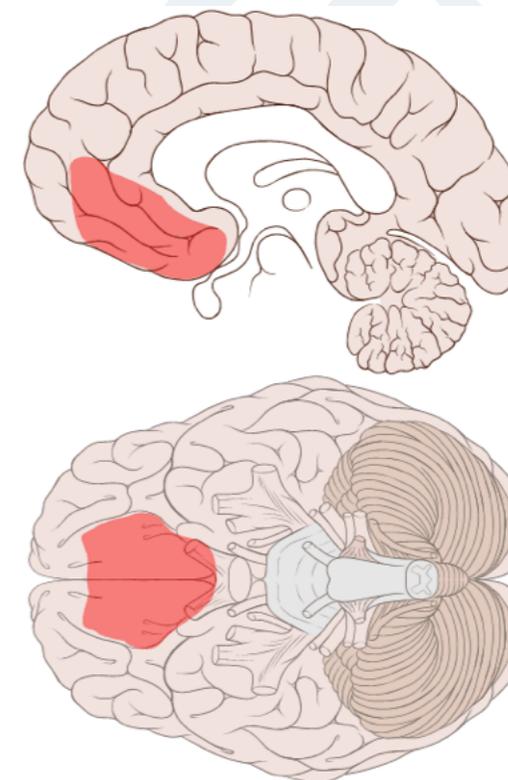
We're now going to examine the role the prefrontal cortex has on our decision making and how it might influence our ability to use the systems outlined in the dual processing model of thinking and decision making in the previous section. The study that we're about to look at suggests that one role of the prefrontal cortex is that it allows us to plan and make decisions based on long-term consequences. In other words, it allows us to process information using system two. We have other areas of the brain that allow immediate responses without much thought, but it's the prefrontal cortex that allows us to exercise control over those initial responses based on consideration of other factors. For example, studies have shown that people who are able to resist temptation and show self-control (using paradigms like the marshmallow test) have higher function in their prefrontal cortex than those that can't (Casey et al, 2011)

Based on these two systems involved in decision making and what we know about the prefrontal cortex already, it seems plausible that people with dysfunction in the prefrontal cortex may have an **impairment** in their ability to use system two processing and rely more on system one when making decisions. We could hypothesize about this in the Vietnam Head Injury Study, as I've done so far with the Dad and the doorbell example. But these are just my hypotheses made up in my imagination – we need strong, solid, **empirical evidence** from studies that can clearly show the connection between our prefrontal cortex and our ability to process information.

Many studies have shown that people with lesions in their prefrontal **cortices** are primarily guided by immediate rewards and may not think about long-term rewards or punishments. (Kim & Lee, 2011)

Within the prefrontal cortex there is a more specific region called the **ventromedial prefrontal cortex**. The parts of the brain are often named for their location. Frontal – front. Medial – in the middle. **Ventral** – means on the bottom. So this very specific name – ventromedial prefrontal cortex, means it's in the cortex (outside), in the prefrontal region (front) towards the middle (medial) and the bottom (ventral). We began broadly but you'll begin to see that the brain is so complex and the function is very specific in very specific areas.

If you can't remember ventromedial prefrontal cortex, you can skip out the ventromedial part. But the more specific terminology you can learn and use, the clearer your explanations in psychology are going to be. Many studies have investigated patients who have



The ventromedial prefrontal cortex is a specific area within the PFC. It is highlighted in red in the image.

Empirical Evidence: Information and knowledge gathered through observation and experimentation.

Cognitive capabilities: This refers to one's ability to perform cognitive tasks.

damage to the **ventromedial prefrontal cortex** and they have shown an inability to learn from previous mistakes and to continue to repeat behaviours even when they result in negative consequences. Other aspects of their **cognitive capabilities** (intellect, problem-solving, memory, etc.) remain normal.

Before we consult the research into the relationship between the function of our brain and our ability to process information, it's important to understand how cognitive processes are investigated in experimental situations. Of course we can't see the mind (at least not yet!). I don't know what's happening inside your mind, for instance. So how can we investigate this in psychology? What happens is that psychologists design an experiment and their dependent variable is the behaviour – that's what they measure. So they have to design really clever experiments to see the relationship between the thinking and the behaviour. Their independent variable might be a type of task that they think requires different types of thinking, and then they measure the product of that thinking by doing some kind of test.

To test the dual process model, for instance, they design experiments that require the participant to process two different types of information and then they time how it takes them to respond. While the study in the next section did not have the specific aim of testing the dual processing model, it is a good example of how behavioural measures in studies can provide insight into cognitive processes.

Guiding Question:

How might damage to the prefrontal cortex influence decision making?

Abstraction Extension:

One way of abstracting relationships is to apply them to a different context. If you can understand how damage to the prefrontal cortex could influence decision making, how could this relationship explain the correlation between PFC damage and aggression? Or PFC function and future success in things like the IB exams or standardised tests? The ability to devise hypotheses that abstract one relationship to various contexts is a valuable thinking skill and one you should work on developing as you progress through this course.

If you're interested...

There's a book called *The Teenage Brain: A Neuroscientist's Survival Guide to Raising Adolescents and Young Adults*. As you're a teenager, you might like to know how your brain is different now from when you were a little kid and how your brain is going to change over the future years. There is a lot of research in the field of the brains of teenagers, especially that which focuses on why teens tend to engage in more risky behaviours than us boring old adults.

(d) Processing and Decision Making while Gambling

In the following study researchers measured the gambling behaviour of participants in order to draw conclusions about the role of a particular area of the prefrontal cortex in decision making. Based on previous studies the researchers hypothesized that patients with damage to their ventromedial prefrontal cortices may not consider future consequences of their behaviour. This could be because of the ventromedial prefrontal cortices role in processing information.

One study compared 17 healthy controls with 8 patients who had **lesions** on their ventromedial prefrontal cortices. By comparing the healthy controls with the patients with damage, they could focus on one variable – the proper functioning of the ventromedial prefrontal cortex. (Bechara, Tranel & Damasio, 2000)

They played what has come to be known as the **Iowa Card Game** or Iowa Gambling Task (named after the university where the research took place). This has been used in many studies and you can play it for yourself online.

It's tricky to describe, but basically there are four decks of cards and participant are told they can choose from any deck of cards. They start with \$2,000 (*not* real money) and they win money randomly when they pick cards from either deck. But sometimes they might have to pay back money – this is why it's gambling.

There are two decks whereby the initial money won is rather small (e.g. \$50) and two decks where the money won is larger (e.g. \$100). But the smaller reward deck also has smaller penalties (so you might have to pay back \$50 every fifth turn), but the larger initial reward deck has bigger penalties (e.g. you have to pay back \$1,250 after nth turn). So in the long run it makes more sense and you'll win more money if you can resist the initial big reward and go for the shorter initial payment with the better long-term gain. There is no real strategy involved¹ except learning to go for low rewards. The game is designed to see how people adjust their thinking (and behaviour) based on learning from experience. Perhaps it's important to note that this was *play* money and they were not really gambling with figures this high – it might have been a very expensive experiment to run if they were!

So there are four decks of cards like above. The cards are just red or black – it's not about what card they turn over that determines how much money they win. There are just two different types of decks: low reward – long term gain (A and C) or high reward but higher long-term losses (B and D). It's important to know that the participants weren't told which deck was which. *They had to learn from experience.*

So the participants had to process information using two systems. According to

Deck A	Deck B	Deck C	Deck D
Win \$50 nine out of ten times	Choose from here and win \$100 7/10	Win \$50 nine out of ten times	Choose from here and win \$100 7/10
One out of ten times pay back \$50	Pay back \$100 2/10 times	One out of ten times pay back \$50	Pay back \$100 2/10 times
	Pay back \$1250 1/10 ten times		Pay back \$1250 1/10 ten times

¹ In fact, the researchers began by using actual playing cards but they found this to be a confounding variable because people thought too much about the possible patterns and it took too long to realise the obvious difference between the two decks.

The Iowa Card Game has been used in many studies. Originally they used real playing cards, but changed to having just red and black cards as people tried to overthink the possible patterns.

This gambling study can show biological evidence to support the dual processing model of decision making. It also demonstrates one localized function of the ventromedial prefrontal cortex.

the dual processing model, system one processing would lead to a fast and automatic decision because it would be based on instinct. Not many factors would be considered except for something like, “Go for high reward!” But system two processing would require more careful consideration – I want money, but actually I might have to pay back more money so is it the best option? More factors would have to be considered.

The results showed that the healthy controls slowly learned to avoid the decks of cards with high rewards but bigger long-term punishments, and opted instead for the low immediate reward but with longer long-term gains (due to less punishments).

However, the patients with damage to their ventromedial prefrontal areas chose the decks with the higher immediate rewards which had long-term punishments. This pattern took a few trials to emerge but generally remained throughout the remaining trials. The patients were less able to consider the long-term factors and consequences of their impulsive decisions, unlike the healthy controls.

Guiding Question:

How does this study suggest that the vPFC plays a role in system two processing?

Abstraction Extension:

Transfer: It’s important that you are able to transfer your learning from one context to another. If what you learn in IB Psychology is only ever going to be useful within the context of IB Psychology, this will be a rather big waste of two years of your life. But if you can begin to transfer what you learn and use it in new ways, suddenly what you learn can stay with you for a long time. While the theme of criminology isn’t always immediately relevant, and in fact, there’s a good chance you won’t even mention criminology in your exam answers, it’s still valuable thinking practice to be trying to abstract significant relationships and to think about how they might be applied in various fields. As you’ve learned more about the role of the PFC in system two decision making, could this be relevant in areas of human thinking and behaviour that aren’t related to criminology? How could PFC function affect learning or studying or addiction, etc.?

If you’re interested...

At time of writing there is an online version of the Iowa Gambling Task available. Playing this game for yourself is a good way to learn about the methodology of the study.

Relevant Topics

- Thinking and Decision Making
- Ethics and Research Methods (BA and CA)
- Localization of brain function
- Origins of conflict

Practice Exam Questions

- Outline one theory of thinking and decision making.
- Explain two ethical considerations related to research on thinking and decision making.
- Discuss research into localization of brain function.
- Evaluate one theory of thinking and decision making.

Research Methods

The **natural experiment** is valuable when studying biological correlates in thinking and decision making. Neuropsychology involves the study of the relationship between biological factors and cognitive processes like thinking and decision making, so using the experimental method where participants have naturally occurring brain damage allow researchers to focus on the relationship between particular areas of the brain and cognitive processes.

Ethical Considerations

Debriefing would be an important consideration in studies using the Iowa Gambling Task because participants may be curious to know why they were being asked to gamble. Moreover, the results of the study and their impact on patients with vPFC damage may have particular relevance for them: they would want to know that their decision making might be impaired. This is a significant finding and knowing about it (or not) could have a major impact on their life.

2.3 The Brain and Emotion

How might our brain affect our experience of emotion?

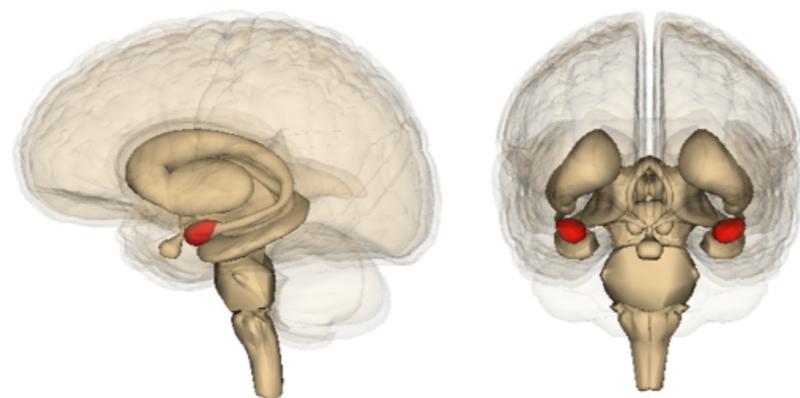
(a) Fear and the Amygdala

Let's look at another important area of study in psychology that involves brain function and mental processes: **emotion**. Emotions are universal and there's no single common definition of emotion or even types of emotions. For instance, could you objectively tell the difference between people who are "depressed" and people who are just "unhappy"? Or at what point does mild amusement become happiness and then jubilation? The feeling of emotion is a complex human experience and we need to always remember that when learning about it and drawing conclusions from research.

In order to understand this complex human experience, we have to investigate the relationship between the brain, thinking and emotion. To do this we're going to first look at the biological factors influencing one particular emotion – **fear**.

We're going to investigate fear because it's an important aspect of human behaviour that has many implications. Moreover, our response to fear is a type of response to a threat, which is an important idea in understanding violent crime. What may be useful to note is that criminals have been characterized as having a lack of fear and an inability to recognise fear in other people's faces (Herpertz, Werth and Lukas, 2001). For some types of crime, this seems to make sense. For example, if someone cannot feel fear then they may be more inclined to do something dangerous, like participate in a shoot-out with a rival gang or get involved in a street brawl. Not being able to detect emotion in others may also inhibit experiencing **empathy** for victims. If one can feel empathy they may be less likely to inflict suffering on others.

There is also a lot of evidence that dysfunction and abnormalities in an area of the brain called the **amygdala** can be found in violent criminals. (E.g. Raine, 1997).



Unlike the prefrontal cortex on the outer layer of our brain, the amygdala is deep within the temporal lobes of the brain.

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Later in this chapter you will learn more about possible relationships between fear and crime, but first it's important to understand where fear might come from².

Our experience of fear is reliant on a few things. First, we need something to be afraid of. When talking about any emotion we call this the **emotional stimulus**. To keep it simple to start with, we'll be looking at **external emotional stimuli** related to fear. In other words, things in our environment that make us scared.

As usual, try to make connections to your own life. We've all felt fear before. When was the last time you were really scared!? What were the physical reactions in your body?

In the previous section you learnt about the frontal lobe and the prefrontal cortex, a section of the outer layer of the frontal lobe. We're now going to look deeper beneath the **cortex** within the **temporal lobe** at a part of the brain called the **amygdala**.



Spiders are an emotional stimuli for many people. Could you hold a tarantula on your hand without feeling scared?

Guiding Question:

How might a lack of response to an emotional stimulus explain violence?

Abstraction Extension:

Generalizability: Does a lack of an emotional response explain all types of violence? The ability to think abstractly about relationships involves thinking carefully about the individual components of the relationship you are explaining. In this case, thinking abstractly about what violence means would enable you to assess the extent to which a lack of fear or emotional response might explain all types of violence. Types of violence include punching, stabling, shooting, rape, etc.

If you're interested...

If the study of criminology interests you, Adrian Raine has a book called *The Anatomy of Violence: The Biological Roots of Crime*. As the title suggests, this book devotes itself entirely to studying the biological correlates of crime. We are merely skimming the surface of this fascinating topic in this course; reading books of this nature in your own time is a valuable way of pursuing your interests further.

² We'll also study fear in more detail when we investigate origins of Post-Traumatic Stress Disorder

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(b) SM: The Woman with No Fear

Studies on the functions of the amygdala go back as far as the late 1800s. Early studies on rhesus monkeys involved removing their entire **temporal lobes**. After this removal they found a change in a number of behaviours, including the fact that the monkeys lost **emotional reactivity**, meaning they didn't react in emotional ways to environmental stimuli. But this involved the removal of the whole temporal lobe – the amygdala is just one part of the temporal lobe. So further replication of these findings was carried out and the monkeys' amygdalae specifically were lesioned and the changes in behaviour were recorded. The results gathered were similar: damage to the amygdalae resulted in **emotional blunting**, a reduction in emotional reactions. (Weiskrantz, 1956)

Numerous animal studies like this have suggested that the amygdala plays an important role in **threat perception**. But what about in humans? It is very difficult to study damage to such specific parts of the brain as the amygdala in humans. Unlike the prefrontal cortex, that is located near the skull and easily damaged, the amygdalae are located deep within the brain and so it's rarer to find people with damage in this area. Moreover, often when people do experience damage in this area (e.g. through a stroke or disease), they also have damage in other areas. However, there are some rare exceptions and when people with particular areas of brain damage occur. Often they are the subjects of case studies. One such patient is known as SM, whom the media have called "the woman with no fear". (Feinstein, Adolphs, Damasio & Tranel, 2011)



Most people would find walking through an abandoned hospital in the middle of the night very scary, but not SM. Her study helps to show the important function the amygdala plays in experiencing fear.

Like the monkey experiments, numerous studies on people with damaged amygdalae have shown that **lesions** in amygdalae of human patients result in a lack of fear. One such study was carried out on a patient called SM, a 44 year old woman with bilateral lesions in her amygdalae that are result of a genetic disorder. (Previous research has shown that she has an impairment in **fear conditioning** (learning to be afraid) and **fear recognition** (recognizing fear in other's faces). This was the first study on SM that tried to see if the amygdala played a role in the **induction of fear** - being made to feel scared. In all other ways SM is a normal person - her scores in IQ, memory, language tests and other test of general cognitive function are as good as healthy controls.

One way they tested her fear was to take her to an exotic pet store where there were lots of snakes and spiders. These are two of the most common fears people have and from an evolutionary view a healthy fear of

these animals is a good thing (because of their potential danger). SM had also told the researchers that she didn't like snakes and spiders and "tried to stay away from them." So they went to a pet store and made notes on her behaviour as they walked around the store. But even though she had told them she didn't like snakes and spiders, SM showed no fear. She held one snake for over three minutes and the researchers noticed that she was curious and inquisitive, touching its skin and its scales, but that she didn't

show any fear. In fact, she said things like "This is so cool" and she even kept asking if she could hold the bigger snakes, but the store owner continually told her continually told her they were too dangerous.

We can see that SM had no fear of something that most people are afraid of. And to test her fear response further they then took her to a haunted house. Every year at Halloween one of the "most haunted places in America", an old psychiatric hospital called Waverly Hills Sanatorium is turned into a haunted house. So even though it wasn't Halloween the researchers created the Haunted House and to make sure their house was in fact scary they invited a few other people to join the group so they could make comparisons between their fear response to the haunted house and SM's. They noted that while walking through the house SM never showed any fear. "Monsters" would jump out from behind dark spaces and SM never seemed to show any physical signs of fear, but would do things like touch their faces instead. Ironically, she even scared one of the "monsters"!

So this case study suggests that the amygdala might play an important role in the experiences of fear in scary and threatening situations. If we have damage to this area of the brain, perhaps we won't be able to experience fear.

Guiding Question:

How does SM's case study demonstrate the role of the amygdala in experiencing fear?

Abstraction Extension:

Generalizability: Thinking critically about research involves assessing to what extent the results from the study can be applied beyond the study itself. One way to assess this is to look at the nature of the subjects of the research. In this case, the subjects in the research mentioned are animals and one woman. To what extent can findings from these studies be used to explain human behaviour? It's important that you provide reasons for your answer: simply saying "one limitation of this study is that it was carried out on animals and can't be generalised to humans" is pointless, and is not demonstrating abstract thinking – it is description. You must show you understand the specific factors involved that influence the generalizability. Part of your explanation, therefore, should include reasons why findings may not be generalised. Can you explain some specific reasons that might influence the generalizability of SM's case study or the animal studies?

If you're interested...

Neurosciencenews.com is an interesting website that has regular stories and articles about the fascinating world of studying the brain. They have an article on SM called "The Fearless SM: Woman Missing Amygdala" in which this case study is explained further.

Fear conditioning means learning to be afraid of something. This serves important purposes for our survival and you'll learn more about this process when you study PTSD.

(c) *The Amygdala and the Fear Response*

So you've had an introduction to the amygdala and seen in research that it is a necessary component of fear, it's time to look a little more closely at how the amygdala may cause us to feel fear. In this section we'll focus only on the biological processes involved after we perceive a threat.

With modern technology, we can now see the functioning of the amygdala when people are exposed to scary or threatening stimuli. When images of snakes, spiders, or angry faces appear on the screen our amygdala is activated. One study used a PET scan to compare the responses in the brains of women being exposed to images of snakes or spiders (things they said they were afraid of) and things they weren't afraid of. The results showed that when looking at the snakes and spiders their amygdala activation was higher than when looking at non-threatening stimuli (Ahs et al, 2009).

One study also suggests that our amygdala plays a particular role in situations when we feel **socially threatened**. A **social threat** is one that comes from another person or group of people, for example someone swearing at you, challenging you to a fight, etc. It's an emotional stimulus that is separate from a natural threat, such as seeing a dangerous animal or being trapped in a burning building. If someone is threatening us, we might need to defend ourselves: this is why we have evolved to have biological reactions that can facilitate **aggression**.

If we think back to the theme of our chapter, knowing about a fear of snakes and spiders has little applicability to something like murder. This is why knowing the term **social threat** is a key concept to understand in this chapter as it is important to really explain what might provoke someone into committing violent crime.

One study that we'll look closely at later in the chapter showed that when people are threatened socially their amygdala is activated. They can see this by putting people in fMRI machines and flashing images of happy, neutral or sad faces and then measuring the activation of the amygdala. When people perceive angry faces their amygdala is activated. But here's my favourite part: the researchers give the instructions to the participants that they are to push a button as soon as they see an emotional stimuli (in this case the picture of the face). FMRI studies show that the amygdala activates before the person has even consciously realised that they have seen a face. (e.g. Williams et al, 2004) Studies have also shown that our amygdala may activate upon perceiving a face from a race different to our own. (Chekroud et al, 2014) This will be explored when you learn about social influence and prejudice.

How does that happen? When there's something threatening in our environment (i.e. something that might scare us) it is perceived by the amygdala. We have seen this already in the existing research. But in order to understand the **physiological response** caused by fear (the increased heart rate, heavy breathing, etc.) we need to know what happens after the amygdala is activated. After a threat is perceived by the amygdala a message is sent to another part of the brain called the **hypothalamus**. The hypothalamus is below the thalamus (hypo = below) and is like a control centre (Imagine an air-traffic controller sitting at a large desk with a whole bunch of buttons or switches, or those little people in the heads of the characters in that Pixar film, Inside-Out). As the hypothalamus receives a signal from the amygdala it needs to get the body ready physically to deal with the threat.

The hypothalamus is involved in activating the fight-flight response (Steimer 2002). It sends a signal to the **adrenal glands**, which are small glands that sit on top of your kidneys and trigger the release of **adrenaline** into our blood stream. You may know

a little bit about this hormone in our bodies, or just you have heard the word before. The term "adrenalin junkie" is a popular one to describe people who love doing those extreme sports like bungee jumping, sky diving, parasailing, jetboating, white-water rafting, etc. When we receive adrenaline in our bodies our heart races, blood pumps faster, we get more oxygen, and we get more instant energy. The reason these sports increase adrenaline is because they trigger in us a natural fear response as we haven't evolved to be used to the feeling of jumping head first off a 200metre high bridge!

But this response serves an important evolutionary purpose: when we are threatened and feel afraid, we need to have the energy to either stand our ground and fight or to run away really fast to escape danger. This is why it's known as the **fight-flight** response. Another name for this is the **stress response**.

Understanding the role of the amygdala in emotion is relevant for the study of criminology, as well as origins of prejudice and possible causes of PTSD.

We'll explore more about the significance of this later.



Many people like to participate in sports that activate our stress response. Are you an adrenaline junky?

Guiding Question:

How does perception lead to the physiological arousal associated with fear?

Abstraction Extension:

Assumptions: This explanation of fear being a product of the physiological processes activated by the perception of emotional stimuli in our environment doesn't include explanations of how we can generate emotion internally. Can we feel fear without having to perceive a fear inducing stimulus? What about other emotions: do you think the explanations of the physiology of fear can be applied to emotions like sadness, anxiety and joy?

If you're interested...

There are many different theories of emotion that you can read about if you're interested. One particular theory of emotion from the 1960s is called "The Two Factor Theory." This theory was originally included in this chapter but its relevance to the current IB Psychology syllabus was questionable and it's a rather complex theory with a more complex experiment associated with it so it was removed. However, if you're interested it does provide an explanation of how emotion could be influenced through internal cognitive processes.

One function of the amygdala is to perceive threatening stimuli and prepare our body to react accordingly.

Emotion and aggression are closely related because an individual is unlikely to be aggressive without feeling emotional. Emotion includes the physiological arousal associated with the stress response.

Relevant Topics

- Localization of brain function
- Emotion and Cognition
- Evolution
- Techniques used to study the brain
- Ethics and Research Methods (BA)
- **HL** Animal studies

Practice Exam Questions

- Contrast two studies related to localization of brain function.
- Describe one technique used to study the brain and behaviour.
- Discuss techniques used to study the brain and behaviour.
- **HL** To what extent are animal studies models useful in understanding human behaviour?

Research Methods

Case studies on individuals with unique characteristics are valuable for psychologists investigating relationships between the brain and behaviour. It is rare to have people with bilateral amygdala damage and so the findings from case studies using patients like SM can be used to corroborate findings from animal studies.

Ethical Considerations

The **right to withdraw** would be a particular consideration involved in the unique methodology of SM's case study as they were deliberately putting her in potentially stressful situations. Participants should always be given the right to withdraw, but this is of particular relevance when the methodology involves potentially high levels of anxiety.

2.4 Hormones and Behaviour

Why are men more aggressive than women?

(a) Testosterone and Aggression

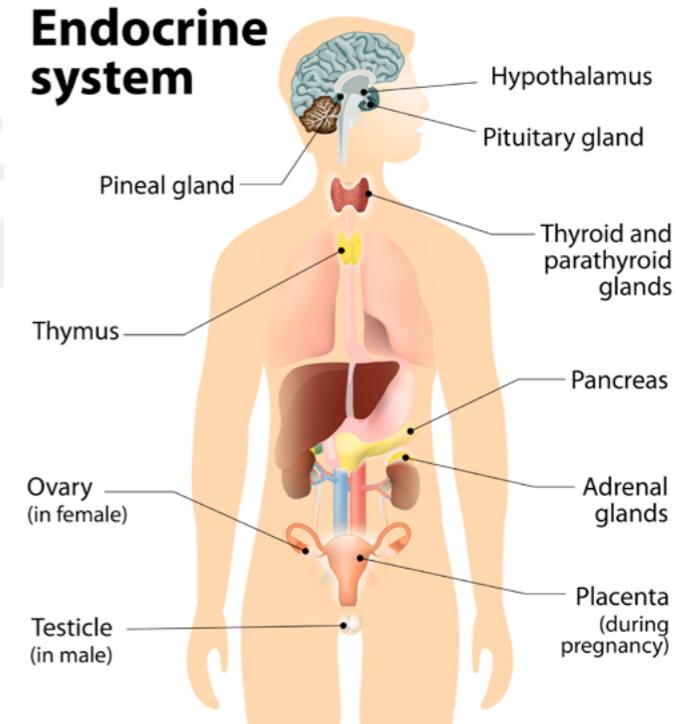
So far we've talked pretty generally about the brain and areas of the brain. It's time now to delve a little deeper into the actual chemical functioning of our body and our brain so we can develop our understanding of how biological factors can influence our behaviour.

A key biological factor in psychology is the **endocrine system**, and its role in releasing **hormones** in our body. Hormones are chemical messengers that are transported through our blood as a result of activation of different glands in the endocrine system. These chemicals perform a number of functions on our physiological processes. Put simply, they are chemicals that can spark physical reactions throughout the body. We've already looked briefly at the way one hormone (adrenaline) might play an important role in the experience of emotion through its impact on the physiological processes involved in emotion.

Testosterone is another hormone that has been studied extensively and particularly in relation to its influence on aggression. Many studies have shown that criminals in prison have high levels of testosterone (e.g. Dabbs et al, 1997 as cited in Batrinos, 2012). More evidence that suggests testosterone might affect aggression can be found in numerous animal studies. These studies follow a similar experimental design as the monkey studies on lesions in the amygdala, but typically they remove the testicles from male animals (often rats) and compare the differences in their aggressive behaviour before and after **castration**.

An example of this can be seen in Walsh et al (1986). In this study they wanted to investigate the effects of changing testosterone levels on the aggressiveness of male rats. They placed rats in cages and identified the **alpha males**. An alpha male is the leader of the colony. In animals, this is typically the biggest and strongest. The term can be applied to any animal group, including humans. So the researchers identified the alpha males and they measured their aggression levels when there was a nonaggressive rat placed in the same cage. They measured aggression by recording behaviours such as biting.

Endocrine system



Testosterone is the male sex hormone and is produced in the testes (and in the ovaries to a lesser extent in females).

After they measured the aggression levels they divided the alpha males into four separate groups to undergo four separate surgeries:

- Castration
- Castration followed by implanting of tubes with testosterone
- Castration followed by implanting of empty tubes
- A “sham” castration followed by implanting of empty tubes (this means they would have cut open the rat and sewn it back up without actually removing the testicles).

They then measured the change in aggression when nonaggressive rats were introduced to the cage. Those that had the operations that reduced testosterone levels (e.g. Group A and C) had a decrease in aggressiveness (e.g. attacking and biting) but those that had the operations that kept testosterone levels in tact (Group B and D) didn't have a significant change in aggression levels.



By experimenting on rats, researchers are able to determine correlations between biological factors and behaviour. Walsh et al were able to manipulate levels of testosterone and conclude that levels of testosterone affect aggression.

This evidence by itself demonstrates a correlation between testosterone and aggression. It was followed by a second operation so that those that had the surgery that decreased testosterone had another operation that increased testosterone (e.g. Group C had their tubes filled with testosterone). Those alpha rats that had their testosterone replaced showed returned levels of aggressiveness similar to those in the “sham” castration group.

Moreover, the researchers observed that when a subordinate male (one that is not the alpha) is placed in the same cage as an alpha rat that has been castrated the lower rat (subordinate) becomes the dominant (alpha) rat in the cage. Also, when a rat that had the sham operation is put in a cage with a castrated rat, the sham operation rat shows higher levels of aggression. This suggests that testosterone may facilitate behaviour associated with **social dominance** in rats.

By comparing the before and after changes of aggression, as well as comparing the results of the different operations, this experiment suggests that testosterone levels influence aggression. The researchers concluded that the role of testosterone in aggression influences social dominance in that those rats that have reduced testosterone lose their place as alpha males.

Much like with the monkey studies, we can see here how animal studies can show us that there is a relationship between testosterone and aggression, but it doesn't tell us much more than that. It's correlational, but we want to go deeper into understanding aggression. Moreover, rats and humans are pretty different animals with different brain structures, so can we really generalize from an aggressive rat in a lab to a serial killer?

Guiding Question:

How does Walsh et al's study suggest a correlation between testosterone and aggression?

Abstraction Extension:

Analysing Questions: If you are asked to “explain how testosterone influences behaviour, the above research is rather limited. It suggests that testosterone does influence aggression but it doesn't provide much insight into how it does. However, if you are asked to explain how research suggests testosterone influences behaviour, the above research can be used in a very good explanation of how the research demonstrates testosterone's role in aggression. However, it's limited to animal studies so the generalizability to humans needs to be questioned. Analysing the demands of the question in order to identify the explanation/s required to demonstrate your understanding is really important, especially in exam situations.

If you're interested...

While rather gory and gruesome, and especially unsettling for boys, there's a rich and fascinating history behind castration that could be worth researching. Castration is used extensively in farming to control livestock while a castrato is the name given to the singing voice and the boy who had that particular singing voice through castration. This was a popular practice in Europe as was chemical castration to treat homosexuality. One famous case of the latter was that of the famous mathematician Alan Turing.

You can see the advantages of using a **laboratory experiment** to manipulate variables in Walsh et al's study. By measuring effects of aggression on manipulations of testosterone levels, a clear cause-effect relationship can be determined.

(b) Aggression: An Evolutionary Adaptation

In the previous section we investigated some basic evidence that suggests testosterone influences aggression. In order to explore more deeply *how* high levels of testosterone could increase aggressive behaviour we need to look again at the way many factors may be involved in this complex behaviour.

Walsh et al's study did identify an important concept: **social dominance**. The role of social dominance and having a strong position within a social group is one that we will explore throughout the following sections. So before we investigate the connection between testosterone and aggression further, perhaps we may need to take a moment and reconsider our thoughts on aggression. In modern society being overly aggressive is generally considered bad because it's **anti-social**. But has this always been the case? A big part of understanding functions of the brain and other biological components, we have to think about things from an evolutionary standpoint. The development of our cortices, for instance, enabled us to develop language, make tools, form social groups, etc., which helped us rise to the top of the food chain. We've also seen that the amygdala plays an important evolutionary role in perceiving danger and preparing our body physically to deal with the danger. This is another **adaptation** that has helped us to survive.

Similarly, aggression may be an adaptive behaviour because it enables us to defend ourselves when we are threatened. Shows of aggression don't always mean actually making physical contact. Sometimes shows of aggression without resorting to *physical* violence could be enough to defeat the threat. Dogs show aggression through growling and growling, for instance, and many males show aggression by clenching fists, puffing up their chests and offering verbal assaults. These signs of aggression might be important in maintaining our **social dominance** (i.e. maintaining a high **social status**). Social status refers to your rank in society. In cavemen times social status might mean being the toughest and the best hunter, which would mean you would have access to more resources. Social status in a modern, industrialized society might mean having a high-powered and high-paying job. In both of these situations, shows of aggression might help to retain status. Status is achieved in many ways across social groups, cultures and genders, so the value of aggression in these situations will vary from situation to situation. Having and retaining social status is key to our survival, because it ensures that when the food and berries are shared around the tribe, we'll get our fair share (we need to eat to live!) If we look weak and we're scared it might be easier for our foes to defeat us, take our hunk of mammoth meat or copulate with our mate.

Evolution is about **survival of the fittest**, but what this means is not who can run the fastest; it doesn't mean fit in that sense. In general biological terms it means the organisms that have the best characteristics (physical and otherwise) for their environment and so are most likely to be able to pass on their genetic material. In animals we pass on our genes by procreating (having babies). Much like other biological aspects in our psychology course, evolution is another one we have to skim over. The key concept for



Displaying signs of aggression may serve an evolutionary advantage. By being aggressive and willing to confront threats and competitors, an individual may be able to keep or improve their social status.

Natural selection is the process of organisms better adapted to their environment surviving and passing down their genes to their offspring. Over time, this results in significant changes in a species.

Having and maintaining **social status** is important because it can increase chances of getting resources that are key to survival and passing on genetic material.

you to understand is that genes will be more likely to be passed on if they affect us in a way that increases our chances of survival and/or reproduction. This may be through an influence on our behaviour. Thus, some behaviour can be explained through understanding how biological traits are a result of evolutionary pressures. That sounds complex, but it is the key to understanding evolutionary explanations of behaviour. The process of evolution works by **mutations** (small changes) happening in the genetic material that are passed on from parents to kids. If a mutation helps an organism to survive, it increases the chances that it will be passed on and so over hundreds of thousands of years those slight mutations add up to mean significant changes. The process of evolution, therefore, is a slow one that takes tens of thousands of years.

Understanding the evolutionary advantage of aggression is important because it helps to explain the effects of testosterone on the amygdala that will be explored in the following sections.

Once more we find ourselves delving deep into the biological aspect, which is fascinating, but we must stop ourselves at some point and begin focusing on the psychology (i.e. the relationships between the biology, the mental processes and the behaviour). The key idea from this section to understand is that our brains have evolved to allow us to think and behave in ways that are likely to increase our chances of survival. Displaying aggression is one of those behaviours because in situations when we are being challenged or threatened, reacting aggressively is a valuable function as it can help us maintain our social status.

Guiding Question:

How might aggressive tendencies be an evolutionary adaptation?

Abstraction Extension:

Hypothesizing: In the following sections you are going to learn more about how testosterone impacts the brain and how this might be an evolutionary adaptation. However, you won't always be provided with the follow-up explanations to questions you may have, so devising your own hypothesis can be valuable in exploring concepts and conducting your own research to further your knowledge and understanding. You can also hypothesize in "discussions" in essay answers in exams. Based on what you have learned already about aggression and criminology, can you make a hypothesis as to how and why testosterone levels may affect particular parts of the brain?

If you're interested...

If human biology and evolution interests you, Desmond Morris' book *The Naked Ape* is a recommended read. In this classic non-fiction text, Morris talks about the human species as if they were like any other animal being observed from a biological perspective. It's really quite interesting reading about humans from this perspective.

Evolutionary explanations of behaviour should include how the behaviour might help an individual to survive and/or pass on their genetic material.

(c) Testosterone and Social Threat Part I

Studies using fMRIs have shown that levels of testosterone in our body can affect the functioning of the amygdala, which is a key piece in the testosterone and aggression relationship. So it seems plausible that aggression might be an evolutionarily adaptive behaviour and so the role of testosterone actually helps to ensure our own survival in times of social threat by reacting with the amygdala. If the amygdala can stimulate the process of pumping adrenaline in our body to get us ready to fight (i.e. act aggressively), it is plausible that the testosterone may impact the function of the amygdala to stimulate this reaction.

This can be seen in one study where the researchers gave 16 healthy young men doses of testosterone on one day and a placebo the next. In both conditions they showed them images of various types of faces, including neutral, sad and angry faces. While they viewed the images their brains were being scanned in an fMRI, much like the similar studies already discussed earlier in the chapter. The results showed that when participants were injected with testosterone they showed increased reactivity of the amygdala and the hypothalamus when they were viewing images of the angry faces. Testosterone was not shown to have the same influence when observing other types of emotional faces. (Geotz et al, 2016).

This study reinforces what we've learned in earlier sections about the amygdala: it plays an important role in **social threat perception**. Seeing an angry face is threatening and we need to be aware of someone who might be ready to do us harm, whereas a sad or neutral face, while activating perhaps a different emotion, doesn't require us to get ready to fight. The activation of the hypothalamus also suggests that the body will release adrenaline as the hypothalamus triggers the adrenal glands during the fight/flight response.

This study quite simply shows that the function of the amygdala can be affected by testosterone levels. Saying aggression is caused by increased activation of the amygdala leaves a lot of questions unanswered. Just because we have more activation in our amygdala doesn't really help explain clearly how that might lead to aggression.

We could say that when seeing an angry face the testosterone increases the activation of the amygdala and the hypothalamus will trigger the adrenal glands to release adrenaline and we will be ready to fight, but it does provide a rather overly simplistic explanation because it misses an important component: cognition.

Aggressive actions and reactions in situations are not simply robotic performances based on biological functions. As we've seen, we can't ignore mental processes when providing a full explanation of human behaviour, so it is important that these are also explored. This will be the subject of the next section.



A social threat is when another person, or group of people, pose a potential challenge to us in a way that may be scary, frightening or dangerous. Testosterone's impact on the amygdala at times of social threat may be an evolutionary adaptation.

Perception means to become aware of something. We perceive information in our environment through our sensory organs. Social threat perception means becoming aware of a social threat.

Guiding Question:

How might testosterone levels affect our "fight" response?

Abstraction Extension:

Application, Causation and Correlation: Prison populations have been shown to have high levels of testosterone. Does this suggest **causation** or **correlation**? Perhaps people who arrive in prison because they have high testosterone levels and this has what lead them to commit violence acts. Or, prisons are such environments where there are many alphas who are competing for social dominance in that highly competitive environment. It's not hard to imagine testosterone levels spiking in situations where you place many alpha males in a cage (literally, in many cases) where they are left to establish their own social structures.

If you're interested...

There is a plethora of research on the role of testosterone in social situations, especially those involving competition. Numerous studies have investigated the role of testosterone in sports matches and how even the observation of victory and defeat can affect spectators' testosterone levels. This would be well-worth investigating, if you are interested.

(d) Testosterone and Social Threat Part II

In order to investigate the relationships between perceiving a social threat, testosterone and the amygdala, Radke et al (2015) designed a pretty complicated, but clever experiment. They hypothesized that the amygdala wasn't just involved in the *perception* of the threat, but the effect of *motivation* to deal with the threat was an important aspect to consider. Now we're getting a little closer to making the connection to aggression. If someone threatens us personally (i.e. they're a social threat) from an evolutionary perspective we need to be able to respond to the threat to keep our social status. If we are in danger of being harmed, we need to be able to protect ourselves. In other words, in real life when we're threatened we feel motivated to defend ourselves and our social status. In the following study, the researchers suggest that it isn't just about experiencing emotion that sparks the activation of the amygdala, but it is about motivation to respond in some way. The results suggest that testosterone works by increasing the activation of the amygdala when we are motivated to retaliate to a social threat, which in turn prepares our body physically for that defense.

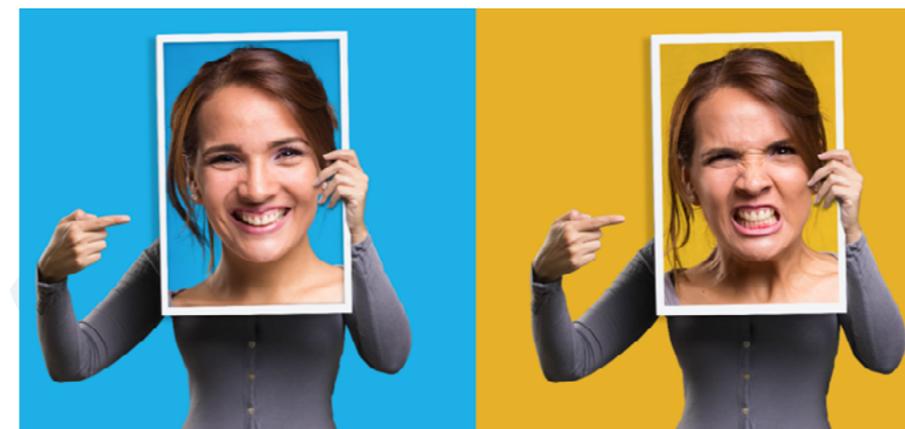
In this study half of the participants (54 healthy females) were given a small dose of testosterone and the other half were given a placebo. As in similar studies, lots of pictures of faces that were either angry or happy were shown one at a time while the participant lays down in an fMRI scanner. For each face that appears on the screen, the participants have to "avoid" or "approach" the face. As they have to lie perfectly still in the fMRI, they avoid/approach the face by moving a joystick with their hand. When pushed one way the stick will make the face gradually appear larger (approach) and when moved another way it will make it gradually appear smaller (avoid). The "approach" is when the face is made to look like it's coming towards the person (i.e. it gets bigger), and vice-versa for avoidance. The faces appeared on the screen one at a time and the participants followed the instructions (approach or avoid). The motivation factor was the following of the researcher's instructions to approach or avoid the faces (which is important to note: the participant's didn't get to choose to avoid or approach, they were instructed). While in the scanner the activity of the participants' amygdala and prefrontal cortices were measured.

The results showed that the group with testosterone had more activation in their amygdala when they were *approaching angry faces* when they were told to do so and the activation was higher than when they approached happy faces. So here we can see that perhaps in a situation that involves a social threat (an angry face) and we are motivated to defend ourselves against that threat, testosterone levels play an important function in increasing the activation of our amygdala which will result in more emotional and physical readiness to react aggressively. The activation of the amygdala may help us get physically prepared for the confrontation by triggering the release of adrenaline into our bodies that will give us the instant energy to fight. And the role of testosterone may be to help prepare for that confrontation, as shown by the fact that the testosterone condition had higher amygdala activation when they were moving the joystick forwards and making the angry face become larger.

But while testosterone might influence aggression at times when we are socially threatened by increasing the activation of the amygdala when we are *approaching* a threat, that alone doesn't yet give us the full picture of how that might lead to acting in a violent manner, like punching or shooting someone.

The study showed that there wasn't a significant difference in the activation of the prefrontal cortex across groups. We've looked at the key role in the prefrontal cortex in being able to process information and make judgements based on long-term consequences, and so it's important not to overlook this function when you are explaining

acts of aggression that have serious consequences. If we have high levels of testosterone, perhaps we won't necessarily react aggressively when we're threatened because we'll be able to regulate that emotional reaction and we'll be able to think through our decisions. However, individuals with existing damage or low functioning of the prefrontal cortex may not be able to do so, which could explain why studies have shown low prefrontal cortex activity and high levels of testosterone in prison populations. In this section I hope you've realised even more how behaviours like violence, aggression and crime are complex and that drawing broad conclusions that ignore specific factors leads to erroneous statements and uninformed opinions.



Radke et al's study showed that testosterone impacted the amygdala when participants were motivated to approach the angry face. How might this help explain the connection between testosterone and aggression?

So in this section we've gone further with our understanding of the amygdala and seen how the many correlations shown between testosterone and aggression could be explained through the effects it has on other parts of the brain. We've also introduced the value of using evolutionary explanations for biology to help with our understanding of human behaviour.

You've also been introduced to the idea that human behaviour involves one more element that we haven't explored much until now: social influences. We will explore this later in the chapter, as humans are naturally social animals and it is our sociability that can impact our behaviour and mental processes in many ways. It's important that when we're applying our understanding of behaviour to explanations of violence that we have to try to test our abstract understandings by applying them to real life examples. This thought process is imperative if you are to develop a full understanding of the applications, and limitations, of psychological research.

Guiding Question:

How can Radke et al's study demonstrate how high testosterone levels may influence aggression?

While Goetz et al showed that testosterone affects the amygdala, Radke et al can show how motivation is an important influence as well. The influence of motivation is key in being able to link the amygdala activation with aggression.

Remember that emotion, amygdala activation and aggression are all related. The activation of the amygdala enables experiencing emotion through its role in the stress response. High levels of emotion could easily lead to aggressive reactions to social threats.

In this experiment, motivation was defined as following the experimenters instructions.

If you don't understand how testosterone influences the behaviour of aggression, there are other topics covered that will allow you to explain how testosterone may affect behaviour (e.g. competition and attraction).

Abstraction Extension:

Ecological Validity and Operational definitions: an operational definition is how a variable is defined in a particular study. In this example, one operational definition was that of “social threat”. In this study they defined this as a face being moved closer or further away on a computer screen. But to what extent does this resemble social threat in a real life situation? A good discussion of the ecological validity of this study would include examples of social threat that this studies operational definition might not apply to, but yet might still result in aggressive reactions. For instance, receiving a threatening email (or Facebook post, tweet or other form of communication) from someone that attacks you personally is still a social threat, but does not involve the perception of an angry face. So ecological validity could be questioned here based on the limited operational definition of the social threat variable. More research into multiple forms of threat and its influence on the amygdala would be required in order to test the generalizability of these conclusions.

If you're interested...

radiolab.org has an interesting podcast called “Forget about Blame?” In this podcast the hosts talk with neuroscientist David Eagleman, who is very much about the biological approach to understanding criminal behaviour. They have some interesting discussions about biological origins of behaviour and culpability.

Relevant Topics

- Ethics and Research Methods (BA)
- Origins of conflict
- Hormones and behaviour
- Evolution

Practice Exam Questions

- Evaluate one study related to hormones and behaviour.
- Outline one ethical consideration related to hormones and behaviour.
- Discuss one origin of conflict.
- Evaluate one evolutionary explanation of behaviour.

Research Methods

The **laboratory experiment** is valuable for isolating an independent variable's effect on a dependent variable. In the studies involving injections of testosterone in samples that have been controlled for other characteristics (e.g a history of violence or antisocial behaviour) we can see the effect that the testosterone levels have on brain function. It's important to note the causation here, however: the causation regarding the role of testosterone on the function of the amygdala in particular situations can be deduced. This does not infer a causal relationship between other relationships, such as testosterone and violent crime.

Ethical Considerations

The **right to withdraw** is an important consideration in any studying using technology like fMRIs. These machines are incredibly noisy, cramped and uncomfortable. Participants need to have the right to stop participating if they are feeling uncomfortable. For instance, they may begin to have feelings of claustrophobia.

2.5 Culture and Biology

How can culture affect testosterone levels?

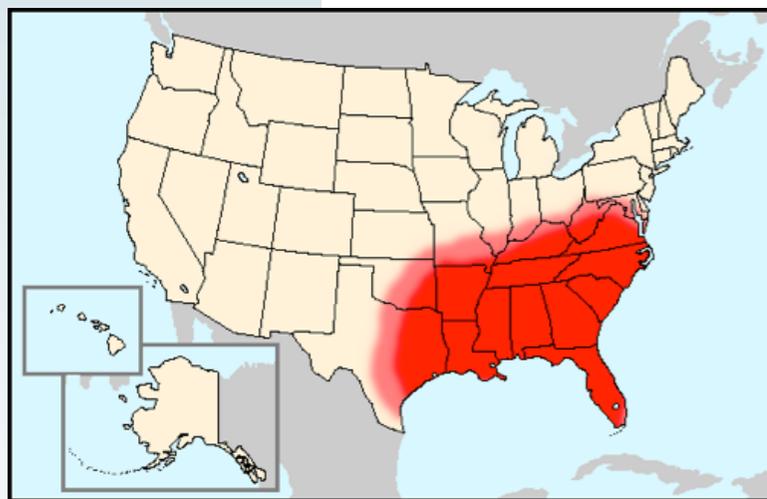
(a) Culture and Cultural Values

In nature we don't have injections that increase our testosterone, so if we want to develop our understanding of how testosterone can influence aggression we need to investigate possible factors that may *naturally* influence testosterone levels.

This has been the source of numerous studies, including some that have shown that testosterone levels can increase as a result of our environment. For instance, if you're watching your favourite sports team play and they win, your testosterone levels may increase more than if they lost (Bernhardt, 1998). And it's not just physical sports, testosterone has also been shown to rise in competitive chess tournaments (Mazur et al, 1992). A lot of research has suggested that testosterone plays an important role in getting the body ready for competition, and that displays of dominance and might facilitate displays of aggression that make someone look and act tougher (Cohen et al, 1996). There are many possible factors that can influence testosterone levels, but in this section we'll look at the interaction of **cultural values** and **social threat**.

A value is something that is believed to be important to an individual; a cultural value is something that a cultural group commonly believes to be important. For instance, in some cultures individual expression and the freedom to make your own decisions is highly valued, whereas in other cultures there might be more of a higher value placed on maintaining good relationships within your family even if this means not doing what you want. So while values are individual beliefs of what is important, these individual beliefs are highly influenced by our social and cultural environment.

Comparisons between cultural values and their effect on our biology, cognition and behaviour was the subject of a study in the United States that compared males from different states in the US (Cohen et al, 1996). The actual details of the study will be explored in more depth in the next section, but in order to fully understand the study it is important to understand its cultural context. The Eastern border of the United States is roughly divided by the "South" and the "North". If you've learnt about American history and in particular the American Civil War, you may already be familiar with the general differences between these two areas within the USA. Cohen et al's preliminary research findings suggested that the South is generally more violent than the North and so they wanted to investigate a possible hypothesis as to why this might be.



The area of the US coloured in red is typically what is referred to when people talk about the "southern states." (image from wiki commons).

A **cultural value** is a term used to describe something that a particular cultural group believes is important. For example, having respect for elders is a cultural value in Japan and is reflected in Japanese language. What cultural values exist in a cultural group you belong to?

Their explanation for the existence for increased violence in the South is based on what they term a "**culture of honour**". This culture of honour, the researchers claim, exists in the Southern States, but not the North. In the South in the USA when America was a young country (having broken away from England) the main economy was based on **herding** (farming animals). As there wasn't a lot of law enforcement or government in the South during this time, men who wanted to survive had to rely on themselves. For instance, if someone tried to steal their cows or their sheep they couldn't go to the police as there often weren't any to protect their herds, so they needed to look out for themselves. In order to do this, a man would have to present an image of toughness, a stern façade that showed he couldn't be messed with. However, this wasn't the case in the North as their economy was more industrial with more cities and less farming and agriculture. There was also more law enforcement (e.g. sheriffs and police officers) so Northerners didn't have to take the law into their own hands.

Interestingly, even though modern society no longer relies on such "Wild West" type behaviour, the values and beliefs associated with the culture of honour seem to have persisted in the South. For instance, Southerners are more likely to condone and approve violence, especially if it is in defense and "...the South exceeds the North only in homicides that are argument-or-conflict related, not in homicides that are committed while another felony, such as robbery or burglary, is being performed." (Cohen et al, p946). This suggests that Southerners might be more likely to use violence when confronted, perhaps in defense of one's honour.

Cohen et al hypothesize that being able to defend one's honour is a value that is particular to Southerners because of historical influences. In the next section you'll learn about how this cultural value may have biological effects during times of social threat.

Guiding Question:

Why are cultural values different between Northern and Southern white Americans?

Abstraction Extension:

Avoiding Generalizations: Whenever we discuss culture and cultural values it is very tempting to make broad generalizations about a culture and overlook the fact that cultures are made up of individuals and individuals are very different from one another. One way to avoid doing this is to identify a culture you belong to and one or two cultural values that could be said to exist in that particular cultural group, but that you do not hold personally.

If you're interested...

The original article that describes the culture of honour and how it came to be in the Southern States is available online. The language is relatively accessible for high school students so if you're interested in learning about this more, or if the explanation here needs clarifying, you'll be able to find this article online using google and the title: "Insult, Aggression and the Southern Culture of Honor".

Cohen et al provide many possible reasons why the **culture of honour** emerged in southern states in the USA. The idea of herding and law enforcement is just one. You can read the full article to learn about the others.

(b) Cultural Values and Testosterone

To test their hypotheses regarding cultural values and responses to confrontations, Cohen et al devised a fascinating experiment that involved insulting Northern and Southern males and testing their responses, including the differences in testosterone levels. The study compares the reactions of American college students to a situation where they were insulted and challenged. The researchers wanted to compare the reactions of college students from Northern states in the USA (e.g. New York, Massachusetts) and Southern States of the USA (e.g. Texas, Georgia, Kentucky).

There were many different variations of a similar experimental paradigm. In one of the experiments the researchers gathered Northern white male participants and Southern white male participants who were told they were taking part in an experiment on judgement. They took saliva samples in order to measure their levels of testosterone so they could compare the changes in testosterone levels (they told the participants they were measuring blood-sugar levels). After an introduction to the experiment, participants filled out a questionnaire and were told to walk down a long hallway to put the questionnaire on a table. As they walked back from putting down the piece of paper, a confederate of the study was pretending to organise a file cabinet in the middle of the hallway. As the participant walked past, the confederate bumped the participant and called him an "a**hole."

The researchers had many dependent variables (which are interesting and you can read more about in the original), but the important one for us is that the testosterone levels of Southern white males increased by 12% from before the experiment began, compared with 4% from the Northern males.

So our level of testosterone that rises getting us ready for conflict in a social situation may be influenced by our cultural values.

Due to the increase in testosterone the Southern white males were more primed for competitive and even aggressive actions. This may be because of their cultural values in that when they are confronted and offended they think about that threat differently because of the value they place on defending their honour. Northerners on the other hand, may find it easier to dismiss the offensive remark, which means there is little increase in testosterone getting them ready to be aggressive.

This could have important implications in the study of violent crime. We've seen how testosterone can increase the body's physiological readiness for aggressive actions and that violent criminals have higher levels of testosterone, but we can't simply put the blame on these biological factors. Our social and cultural environment may affect our values and our thinking, which could in turn affect our physiological processes in certain circumstances. Here we see once more the complex interactions between social, biological and cognitive influences when trying to understand complex human behaviours such as aggression, violence and criminal behaviour.

Cohen et al had numerous experiments with subtly different conditions. It's pretty interesting to read the other variations as well. For example, they also measured cortisol levels (a hormone released during times of stress).



How would you react to someone insulting you? Would you feel a need to defend your honour, or would you be able to brush it off?

It's important to note that these results by themselves don't show that testosterone can cause aggression. The earlier research showed that relationship. This study provides a possible explanation for why some people might have higher testosterone levels than others.

Guiding Question:

How might cultural values influence aggression?

Abstraction Extension:

Population Validity: Population validity is the extent to which findings from one study can be valid in terms of applying to a larger population (it affects generalizability). This research focused specifically on Southern White males. Why do you think they focused only on southern white males? Why not males from other cultures? Based on this limited sample, to what extent can these findings be generalized to other situations where social factors may influence cognition, biology and aggression? Are there other social environments that exist in society today that might pass on values similar to the "culture of honour" which may have similar to affects to the one explained above?

If you're interested...

There's an interesting article called "The Role of Testosterone in Social Interaction" by Eisenegger, Haushofer and Fehr that is available online. This article goes further into explaining the role that testosterone plays in social interactions.

Relevant Topics

- Ethics and Research Methods (BA, SCA)
- Origins of conflict
- Hormones and behaviour
- Culture and behaviour

Practice Exam Questions

- Explain one study related to hormones and behaviour.
- Discuss one ethical consideration related to hormones and behaviour.
- Describe one study related to culture and behaviour.

Research Methods

Social psychologists like Dov Cohen also use the **experimental method**. This is another study that is difficult to categorize, but there's definitely a variable (cultural background) that is being studied in relation to another variable (aggression and testosterone levels in response to insult). Experiments in social psychology enable researchers to investigate the effects of social variables on behaviour.

Ethical Considerations

Informed consent would need to be considered carefully in Cohen et al's study. On the one hand, you probably need informed consent in order to ensure your experimental design can be approved by ethical review committees. However, they would have had to carefully consider just how much information to provide participants so as to ensure the validity of their results. For example, they can't tell them that an actor will insult them because this would affect the behaviour of the participant and could be a confounding variable. Here we can see that the combination of informed consent and **debriefing** is often important in research.

2.6 Neurotransmission

Can chemicals in our brain cause violent crime?

(a) Neurotransmission

We've looked at one type of chemical messenger in the body, hormones, and now we're going to look at a second type of chemical messenger, **neurotransmitters**. Whereas hormones are chemicals transmitted through our bloodstream, neurotransmitters are chemicals transmitted through cells in our body called **neurons**. Remember we have **billions** of neurons in our brain. We also have neurons throughout our **central nervous system (CNS)** and our **peripheral nervous system (PNS)**. The central nervous system is our brain and our spinal cord, while the PNS consists of nerves outside of the CNS. These nervous systems are how we receive and respond to **sensory information**, like external emotional stimuli.

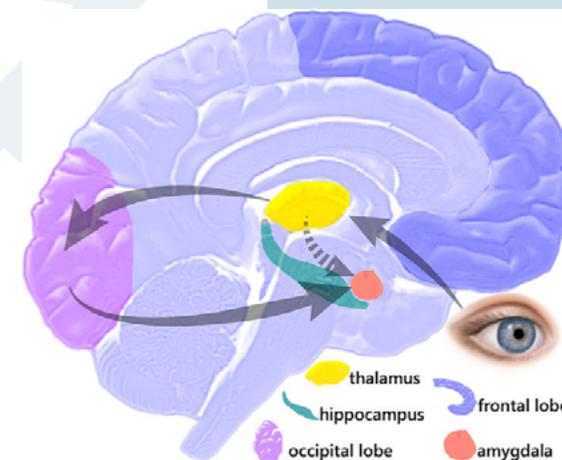
Our nervous systems perceive and interpret environmental stimuli through our **sensory organs**: our ears, eyes, skin, tongue and nose. These organs are responsible for **sensory perception**: detecting environmental stimuli such as what we see, hear, taste, touch and smell. When an environmental stimulus is detected, our sensory organs send messages to our brain through a process called **neurotransmission**. Neurotransmission is the process of neurotransmitters being sent from one neuron to the next at a speed of anywhere from one to over 200mph. This rapid transmission of chemicals throughout the nervous system allows you to perform complex behaviours and cognitive processes quickly. In psychology when we're talking about the level of **brain function** or **brain activity** we are referring to the level of neurotransmission happening in particular areas of the brain. This is what brain scanning technology like fMRIs and PETs measure.

When sensory information is detected through our sensory organs, neurons in the stimulated area are activated and send messages along **neural pathways** through particular areas of the brain. A neural pathway is a series of connected neurons that go through the process of neurotransmission between particular areas of the nervous system. Sensory information is sent along neural pathways to the relevant area of the brain that processes that type of information. For example, you have a particular area of your brain that processes hearing spoken language and a different part for processing written language (i.e. when you are reading). You even have a particular area of your brain that processes drawing, watching and imagining cartoons. This is the concept of localization of brain function that was introduced earlier in the chapter.

I like to think of neural pathways as kind of like roads of neurons. If we continually practice something and have lots of repeated experience with receiving sensory stimulation and responding to it in a certain way (e.g. catching and throwing a ball, typing on a computer, listening to and understanding a new language) the neural pathway will become well-developed and strong, like a big highway of chemical and electrical

Understanding the process of how our environment can affect brain function will be helpful when learning about neuroplasticity in the next topic.

Hormones and neurotransmitters are quite similar. In fact, some chemicals can be both neurotransmitters and hormones.



This is an illustration of how emotional information perceived through our visual sensory organ (our eyes) may be transmitted through various parts of the brain related to processing emotional stimuli.

signals being fired through the brain. If we don't use a particular neural pathway often or the sensory perception is new, it's a bit more like cutting a way through an overgrown jungle path. This is why when we begin a new task like learning a new sport, instrument or a language, we feel slow and clumsy – our neural pathways are underdeveloped. We will learn more about this later when we study **neuroplasticity**.

Particular neural pathways and areas of the brain also have various levels of specific neurotransmitters. **Neuropsychology** often involves the correlations between levels of specific neurotransmitters in particular areas of the brain and our behaviour. Here are some neurotransmitters and their correlates:

Neurotransmitter	Behaviour/Cognitive Process
Serotonin	Mood, sleep, impulsive behaviour, violence.
Dopamine	Love, motivation, pleasure, learning.
Acetylcholine	Muscle movement, learning, memory.

You can see from the wide range of behaviours that these chemicals are associated with that the relationships between neurotransmission, the brain, and behaviour is rarely simple. In the next section we will look at a very specific relationship: how levels of serotonin may influence violence through its effect on the prefrontal cortex during times of social threat.

There are many factors that can influence neurotransmitter levels, including sleep, diet, exercise, medication and drug use, genetics, and other environmental influences. In the next section you will see how perhaps diet, levels of **serotonin** and violence may be related.

Guiding Question:

How do particular areas of our brain receive relevant information about environmental stimuli?

Abstraction Extension:

Over a hundred years of neuropsychological research has shown that our ability to process information and perform cognitive processes is a result of the biological process of neurotransmission. These findings may challenge existing notions of what happens when we die. Our ability to remember, think and feel makes us who we are. So if we lose the biological ability to perform these tasks (e.g. when we die and our neurons stop firing), can we have perceptions and perform cognitive processes in the afterlife? If so, how? If not, what type of afterlife are we going to experience without sensory experience or cognition?

If you're interested...

There is a very famous book of case studies with people with brain abnormalities called *The man who mistook his wife for a hat* by the late, great Oliver Sacks. If you're interested in learning about the brain and how abnormalities and dysfunction in particular areas of the brain can affect our behaviour, this is a fascinating book to read. You can also watch Sacks' TED Talk about hallucinations and the brain. It is in this talk that he mentions the very specific area of the brain responsible for processing cartoons.

(b) Serotonin, Threat and the Prefrontal Cortex

The neuropsychological world of neurotransmission is extremely complex, so in this section we're going to focus specifically on how changes in levels of **serotonin** may affect our behaviour. Serotonin has been shown to affect many behaviours, but we'll focus on how it might be correlated with aggression and violent crime.

Numerous research studies have shown that violent criminals tend to have low levels of **serotonin** (e.g. Moi and Jessel, 1995; Scerbo and Raine 1993). Studies have also shown that serotonin is associated with controlling impulsive behaviour (Pattij, 2008). Hopefully from what you've learned already in this chapter you'll be able to start making predictions about the areas of the brain that might be associated with serotonin levels and impulsive behaviour.

Many experiments using rats and other animals have shown that changes in serotonin levels affect aggression (e.g. Annemoo et al, 2000). But the same problems exist in these studies as with other animal studies we've looked at: they don't show *how* serotonin can affect aggression, they just show that it does. Because of the complex nature of the way serotonin is communicated through the brain and the difficulty of manipulating aggression in a lab, it's been difficult to explain *how* serotonin affects violence. With modern technology, however, researchers can now investigate the relationship between areas of the brain and neurotransmission in ways they couldn't before. The following study provides one possible answer for explaining the relationship between neurotransmission (serotonin levels) and violent behaviour by measuring brain activity in an fMRI when participants' serotonin levels are manipulated and they are exposed to emotional faces.

Passamonti et al (2012) gathered healthy volunteers for an experiment where their serotonin levels were manipulated by altering their diet. A repeated measures design was used where on one day they were given a drink that lacked **tryptophan**. Tryptophan is an important amino acid that helps build serotonin and so a lack of tryptophan in the diet will reduce levels of serotonin available in the brain. In the control condition they were given a placebo, which was the same type of drink to consume but contained normal amounts of tryptophan. The expected effect of the reduced tryptophan would be reduced serotonin levels. The participants were then put in fMRIs and their brain activity was measured while they were seeing images of happy, angry and neutral faces. The researchers could see the activation of the brain, including the amygdala and the prefrontal cortex.

The results showed that there was reduced activity in the frontal lobe during the low serotonin conditions. Importantly, the disruption occurred during the angry faces, but not during the sad and neutral faces. Which means that it's not just any stimulus that is affected by serotonin, but a *threatening* stimulus in particular. The reduced activation of the prefrontal cortex might affect violence through our inability to regulate impulsive actions and/or reactions to social threat. If someone has low levels of serotonin and they are threatened, they may not



A common experimental paradigm involves the use of images of faces that are expressing different emotions. Researchers compare brain activity when processing different types of emotions.

Serotonin is associated with many different behaviours. Impulsive, antisocial and aggressive behaviour are only some of the behaviours that research has correlated with serotonin.

There is currently no way of measuring serotonin levels in the brains of living people. It is measured using spinal fluid or in this case, assubmed by measuring levels of tryptophan.

Tryptophan is an amino acid found in food. It helps to build serotonin. Passamonti et al's study suggests that diet could be a contributing factor to aggressive behaviour.

A **neural pathway** is a series of connected neurons that send signals throughout different areas of the brain and the body.

The process of **neurotransmission** can be quite complex. In biology class you might learn more about this process. This topic focuses on how one specific neurotransmitter, serotonin, might affect behaviour.

By reducing the communication between the amygdala and the prefrontal cortex during perception of threatening stimuli, serotonin may affect an individual's ability to regulate their emotional reaction.

Remember that these topics are all interrelated. You should be trying to apply what you already know about topics such as the PFC, the amygdala and emotion to this new topic, serotonin.

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have the function in the PFC to enable them to think through their actions and might react impulsively.

The results also showed that there was disruption of the communication between the amygdala and the frontal lobe. The researchers concluded that this evidence supports the idea that the serotonin impacts the prefrontal cortex role in suppressing negative emotions generated in the amygdala as a response to the threatening face. In other words, when we perceive an angry face we might instinctively feel a negative emotion in response to that angry person. This emotional response is instinctively generated in the amygdala and may be the basis of aggressive and other highly emotional reactions. If our PFC is functioning properly we may be able to suppress (reduce) our negative reaction to someone's anger towards us. However, with low functioning PFC our amygdala may activate in reaction to perceiving the angry face and we may not be able to reduce our emotion or behavioral response to the angry face, thus increasing the likelihood of an aggressive or violent reaction.

Guiding Question:

How can the results of Passamonti et al's study explain the correlation between serotonin and violence?

Abstraction Extension:

Areas of Uncertainty: When applying correlations like the one shown in the above study there are often areas of uncertainty as to the extent to which a single relationship (i.e. between serotonin and perceiving an angry face) can be applied to explain a complex behaviour like violent crime. Often a single explanation is not strong enough, or it could be made stronger by combining another concept. Here we can see that serotonin can influence the prefrontal cortex and the amygdala. After you've explained this relationship, the next could be to explain hypotheses about how the combination of low serotonin and high testosterone might influence aggression. This could be an example of triangulation: using more than one data point to explain a relationship.

If you're interested...

Dr Molly Crockett was a co-author of this study. You can watch her give a TED talk about the importance of being aware of publications of psychological research in the popular media called "Beware neuro-bunk." She also gives another TED talk called "Understanding the Brain" where she talks about the implications and applications of neuropsychology.

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Relevant Topics

- Neurotransmission
- Ethics and Research Methods (BA)
- Origins of Conflict
- Evolution

Practice Exam Questions

- Explain how one study demonstrates an effect of neurotransmission on human behaviour.
- Outline one ethical consideration related to research on neurotransmission.
- Describe one study related to evolution and behaviour.

Research Methods

Much like the testosterone studies, manipulating physiology (as Passamonti et al have done with tryptophan and serotonin) is an important characteristic in many **true experiments** that aim to investigate relationships between the brain and behaviour. By designing careful experiments, researchers can further investigating causal relationships between variables like neurotransmitters and their effect on particular areas of the brain in particular circumstances. But remember that just because it causes an effect on the brain, doesn't mean to say it *causes* behaviour.

Ethical Considerations

Whenever participants are going to be ingested with substances (like the drink they had to consume in Passamonti et al's study) **informed consent** and **debriefing** are important. They should be made to feel confident that the substance they are ingesting will not have any long-term side-effects. Moreover, if they are deceived of the nature of the substance they need to be debriefed about what it was they actually consumed and why.

2.7 Neuroplasticity

How can the way we think affect our brain?

(a) Environment and Brain Development

Neuroplasticity is the phenomenon of the brain developing new neural pathways as a result of repeated experience of something. This ability of the brain to grow and change as a result of experience is a relatively new concept discovered in psychology. For many decades researchers believed that the structure of the brain was fixed and could not change. Early animal studies and recent studies using the invention of technology like the MRI show that this is not the case.

Neuroplasticity refers to the brain's ability to demonstrate **plasticity**: the quality of being easily shaped or moulded. Repeated sensory stimulation, such as what we see, feel and touch, will affect the extent to which neural pathways are developed between particular areas of the brain. The construction and maintenance of these neural pathways is what leads to changes in our brain's function and structure.

When learning about serotonin earlier, you learnt about the internal process of sensory organs receiving information and connecting different parts of the brain. With this understanding it is now possible to begin investigating in more depth just how our environment can affect our neurological development, i.e. how neuroplasticity occurs.

The more sensory stimulation we have in our environment, the more input our sensory organs will detect and want to respond to. Moreover, lots of different types of sensory stimulation will require many different areas of our brain all activating and communicating with one another through neurotransmission. The more our brains are active, the more connections (neural pathways) will require developing. Some of the first studies investigating the effects of sensory stimulation on brain development were carried out by Rosenzweig and Bennet in the 1960s (as reviewed in Rosenzweig and Bennett, 1996). Like we've seen before, they used animals to test their initial hypothesis about correlations between the brain and behavior.

In one of these experiments male rats were chosen from different litters to be randomly allocated to two different conditions: an **enriched condition** and a **deprived condition**. In the enriched environment there were about 10-12 rats with a range of toys that the rats could play with. This group also received "maze training". The deprived cage was slightly smaller, the rat was alone and the cage was isolated in a separate room from the other cages. Both conditions had adequate food and water. The rats lived in these different conditions for four to ten week periods (approximately 30-60 days). After these treatment periods, the rats were autopsied in order to determine if any differences had

developed. To reduce **researcher bias**, a **blind procedure** was used where the scientist doing the **autopsy** on the rats did not know which type of cage they had been in. The rat's brains were dissected and various sections were measured, weighed and analyzed to determine the amount of cell growth and levels of neurotransmitter activity.

They found that rats living in the enriched cages developed heavier and thicker frontal lobes. Replications and further studies found that the brain weight of rats in enriched environments were 7 to 10% heavier than those in deprived ones. The results were quite groundbreaking at the time as they challenged the long standing idea that brain growth was fixed from birth. These researchers were so surprised by the results that they replicated the research numerous times and with each replication the same results were obtained, demonstrating the studies **test-retest reliability**.

Here we can see that **sensory enrichment** and **deprivation** might influence brain development. Sensory deprivation simply means not having much information coming through your senses (what you see, hear, think, feel, taste, etc.) All of this sensory information stimulates the brain and increased stimulation of senses means that multiple areas of our brain can be functioning and increased practice (or lack of) over time can have a profound effect on our brain's development.

The rats in the enriched environment would have been socially interacting with other rats. Not quite talking, but communicating, playing, bonding, smelling, etc. This social interaction would have required numerous areas of the brain to function. Playing with toys, running wheels and receiving the maze training would have also required plenty of regions of the brain to activate and communicate with one another. In order to learn and perform these tasks, the rats' neurons would need to be making more connections, resulting in growth in those areas of the brain (e.g. the frontal lobe).

Another exciting new discovery in neuropsychology is that research findings suggest we are able to grow new neurons in our brain: this was previously thought impossible. This phenomenon is called **neurogenesis**. Research into neurogenesis is in its infancy, but it has exciting possibilities.

Guiding Question:

How does this experiment show our environment can influence brain development?

Abstraction Extension:

Triangulation: The relationships demonstrated in studies can be determined to be more reliable if the same procedures are replicated many times and the same results are gathered. When this happens it's called **test-retest** reliability. The above study could be said to have test-retest reliability because they replicated the experiment numerous times before publishing their findings. Getting data from more than one source is an example of **data triangulation**. How could Passamonti et al increase the reliability of their conclusions?

If you're interested...

If you're interested in neuroplasticity and neuroscience, I highly recommend the fascinating book called *The Brain That Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science* by Norman Doidge. This is a collection of stories about how principles and practices relating to neuroplasticity can be applied to benefit people who suffer from brain dysfunction.



Rats in cages with other rats and more toys end up having heavier brains. The stimulation they receive by social and environmental action is causing their brains to make more neural connections, which is why their brains become heavier.

(b) Childhood and Brain Development

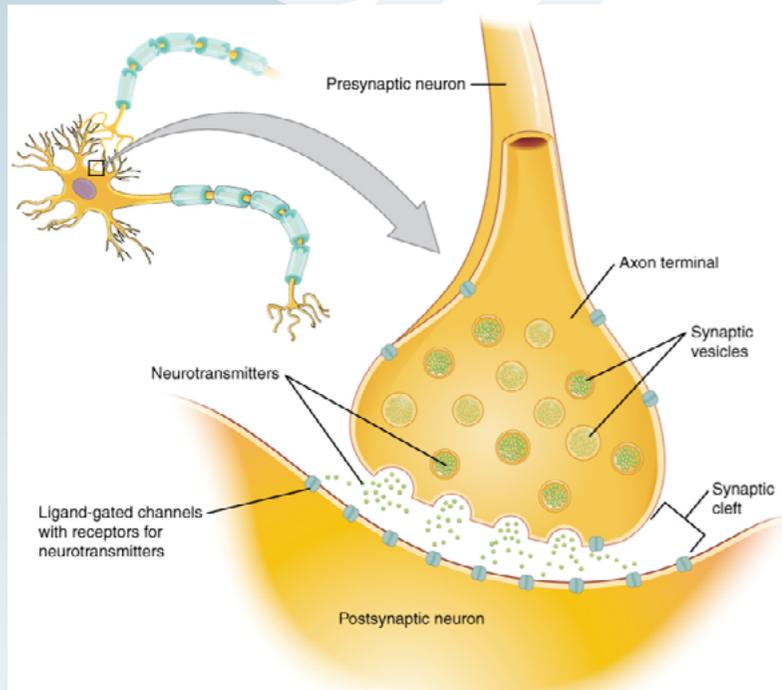
With Roswenzweig and Bennet's research we see the problem again of generalizing results from animal studies to humans. We have seen that having enriched experiences can influence the brain development in rats, but can we really apply this to humans?

All mammals have neurons and the basic structure is similar across species. In fact, early research into the functioning of neurons used a type of sea snail that has abnormally large neurons, so it was easier to examine their structure and function.

When new learning is occurring neurons need to create more **synapses**, so connection between and growth of more **dendrites** and **axon terminals** (the branch like things that connect neurons with one another) to connect more neurons throughout the brain. Connections will be weak when we are learning something new because areas of the brain involved in learning the new task or skill haven't had to communicate with one another before. Neurons need to create more synapses in order for the neurotransmission to occur. In the previously mentioned rat study by Rosenzweig and Bennett, **synapses** increased by about 20% when the rats were in enriched cages (Rosenzweig and Bennett, 1996). This shows that the dendrites and axon terminals were making more connections as a result of having more sensory stimulation. This would allow faster and more fluent neurotransmission to occur between different areas of the brain.

But how can we test the effects of environmental stimulation and deprivation on humans? There are obvious ethical issues with conducting such an experiment on humans: most people wouldn't agree to being locked in a cage for a month and definitely wouldn't agree to this being done to their child. So we see the value of the **natural experiment**. Sometimes these experimental conditions (being in an enriched or deprived environment) occur in the natural world and this allows researchers to investigate the same types of factors affecting our biology as have been investigated on animals in the laboratory.

Researchers made the use of one natural occurring form of environmental deprivation by using MRI scans to compare the brains of neglected children aged 0 – 17 years old (Perry and Pollard, 1997). They investigated many types of **neglect**, including social, physical, cognitive and emotional. They compared some kids who experienced **global neglect**, meaning they experienced multiple types of neglect. MRI results showed that the children who experienced global neglect tended to have less **volume** in their cortices (i.e. their cortices were smaller on average). MRIs tend to measure volume in particular areas of the brain. Volume simply refers to capacity: the more volume the more connections you have between neurons.



In this image you can see a neuron communicating with another neuron (insert) and a close-up view of how this is happening at the synapse. (courtesy of OpenStax via wikicommons)

Perry and Pollard's full text (1997) is available online if you are interested in reading the full article.

Being neglected as a child leads to having less sensory stimulation. Less stimulation will lead to a lack of connections being made in important areas of your brain and poor brain function in key areas has been correlated with anti-social behaviours like aggression and violence. Interestingly, one punishment commonly used in prisons is solitary confinement, where the inmate is locked in a small, dark, cell away from other inmates and any form of social interaction. This is designed to reduce bad behaviour, but perhaps it only further weakens important areas of the brain that are needed to control violent impulses and antisocial behaviour in the first place.



From what you know about the interaction of the brain and our environment, you can hopefully provide explanations as to why neglect may have damaging effects on the brain.

Poverty is another environment variable that has that has been correlated with brain development. A number of studies have investigated correlations between **socioeconomic** status and brain development and similar results are found: children from poorer areas tend to have less volume in their **hippocampi** and **amygdalae** (e.g. Luby et al, 2013). The hippocampus is another important area of the temporal lobe associated with learning and memory. Studies have shown that it plays an important role in transferring short-term memory into long-term memory. You'll learn more about this part of the brain when studying PTSD. You'll also learn about how exposure to traumatic experiences in childhood and adult can negatively affect brain function and structure.

In summary, this research on humans seems to corroborate what earlier animal studies suggested about the effects of the environment on brain development.

Guiding Question:

How does research show that childhood environment can influence brain development?

Abstraction Extension:

Alternative Explanations: The guiding question above is leading towards developing an explanation of how neglect and poverty might affect brain development. An important abstract thinking skill is being able to offer alternative explanations for relationships. The correlation between poverty and brain development could be explained through the fact that if people don't have enough money to provide stimulating toys and experiences for children their brains might not develop as well as those kids who do have plenty of enriching experiences. But can you offer a counter-explanation for this relationship? For instance, could genetics or stress be factors involved in the correlation between poverty and brain development?

If you're interested...

A documentary was made about Norman Doidge's book (mentioned in the previous "If you're interested...") and can be found online. In this documentary you can watch examples of neuroplasticity being put into practice to help people who suffer from brain dysfunction. My favourite part of the film is when Doidge tries to count to ten while having mild electric shocks being sent to the parts of his brain associated with language processing.

We're now moving into combining our understanding of origins of behaviour with treatments. If we can better understand underlying causes of antisocial behaviour, this allows for more effective treatment and prevention strategies to be developed.

(c) Meditation and Mindfulness

From these results we can see that enriched and deprived environmental experiences in childhood can affect the brain development of children. But how does this apply to criminology? The simple answer is that if violent criminals have poor brain function in key areas such as the prefrontal cortex, perhaps this is a result of their childhood experiences. This raises interesting questions surrounding **culpability** in criminals: If a person commits a violent crime that can be explained through poor brain function, and their poor brain function can be explained as a result of environmental experiences beyond their control (e.g. childhood poverty, neglect, trauma, etc.), to what extent can we blame them for their actions?

This question is sure to raise some heated responses and it makes for an excellent classroom debate if enough students feel strongly about the discussion. But even if we can't come to an agreement about where the blame lies for violence in society, surely we can agree that we should be implementing strategies to reduce it. This is where the field of neuroplasticity can have significant implications and applications: if we understand the brain structures and biological correlates of violence, and we know that the brain can change as a result of experience, can we develop strategies to improve functions in areas of the brain like the prefrontal cortex in people prone to violence?

There are many factors that influence the brain's development, including stress, diet, exercise, genetics, and as we've already learned, experience. Let's look at one new idea that is slowly beginning to influence the justice system: **mindfulness** and **meditation**. Some prisons are beginning to implement strategies in mindfulness for their inmates. Mindfulness is a kind of meditation.

There are many different ways to practice mindfulness but it essentially involves a deep concentration that focuses on being aware of yourself and your thoughts. Usually when we try to clear our mind and relax, we encounter one of two problems. Sometimes we become bored. Other times our mind jumps to agitating thoughts, for example we might remember a text message we need to send. Either way we allow our thoughts to stray and sometimes it's hard to get our concentration back. Mindfulness challenges us to keep our minds from being distracted and to focus instead on being completely present. Essentially, we turn our attention to our minds themselves, and think about where our thoughts come from, and where they go. This is no easy feat, but there are many well documented health benefits associated with mindfulness, including significant reductions in stress and anxiety. When you try being mindful you'll realise it involves significant concentration, which is a function of the prefrontal cortex. Repeated use of the prefrontal cortex in this way can lead to connections in the prefrontal cortex strengthening and even an increase in volume.

The best way to learn about mindfulness is to practice it. After a mindfulness session, try to reflect on the level of effort you needed to apply in order to maintain concentration. This effort requires your prefrontal cortex. If you practice this type of high-level concentration for extended periods and over a long period of time, your neurons in this area will improve connections and neurotransmission will happen faster and more easily along newly developed neural pathways. For instance, studies on monks have shown correlations between meditation and brain structure. One study found a correlation between the density of the prefrontal cortex and meditation practice (Lazar et al, 2005).

Here we can see that our brain doesn't just change as a result of *external* stimuli – we can induce changes in our brain structure through mental processes that we initiate in our minds. The way we think over long periods of time can really change our brains.

Guiding Question:

How might meditation and/or mindfulness improve the functions of the prefrontal cortex?

Abstraction Extension:

Hypothesizing: One of the exciting processes involved in studying psychology is generating questions and possible areas to inquire for yourself. Do other behaviours affect the prefrontal cortex? Do other behaviours and/or cognitive processes rely on function of the prefrontal cortex? Can you maintain concentration in class for long periods of time? Could the rise in diagnosis of disorders like ADHD be correlated with the prefrontal cortex? Unfortunately, we don't have the time to explore all your possible questions, but generating these questions and hypotheses can make the study of psychology more interesting and can enliven class discussions. It's important to note that often these questions just lead to more questions, and there aren't always definitive answers in psychology.

If you're interested...

The most difficult part about writing this topic on neuroplasticity is all the fascinating research I've had to leave out. There are heaps of studies investigating the relationship between experience and the brain. If you can think of a behaviour or cognitive process, chances are it's been studied in relation to neuroplasticity. Playing video games, using social media, and learning to juggle are just some of the areas of study in the effects of experience on the brain. These could make interesting EE topics.

Are there any circumstances you feel that a criminal could be excused for their actions?

Meditation has many forms. It essentially involves intense focus and concentration on particular thought patterns. Mindfulness could be viewed as a type of meditation whereby one's thought patterns try to focus on being in the present moment.

(d) Mindfulness and Emotion

If people who have dysfunction in their prefrontal cortices and amygdala can be trained in meditative practices, perhaps they will be able to better regulate their emotional and behavioural reactions when they are in threatening situations and feel the impulse to react aggressively.

Evidence for the possible effects of such training comes from a study by Desbordes et al (2012) where they compared the effects of mindfulness training on the response of the amygdala to emotional stimuli. There were three control groups and one treatment group. The treatment group received eight weeks of mindfulness training. One of the control groups received no training while the other two controls received cognitive training that wasn't related to mindfulness. After eight weeks they had the participants return to the lab and undergo more fMRI testing.

Earlier studies showed that the activation of the amygdala is reduced when viewing emotional stimuli when people are in a meditative state: this study wanted to see if the effects of mindfulness training would still last even when people weren't consciously being mindful at the time they were viewing emotional stimuli. Participants lay in an fMRI and the activity of their amygdala was recorded as they were shown various images of stimuli that were hoped to get an emotional reaction (positive, negative or no reaction). These would have just been pictures of things that would stimulate a happy response (e.g. people smiling), a negative response (e.g. a car crash) or a neutral response (e.g. a loaf of bread).

This study was based on initial findings that suggested that activation of the amygdala in response to emotional stimuli is reduced when participants are in a mindful state. The results of the study showed that there was a reduction in the activation of the amygdala of the group that underwent the mindfulness training when they were viewing the negative emotional stimuli.



Desbordes et al's study shows that extended practice at mindfulness could help reduce activation of the amygdala during perception of emotional stimuli. This could have applications in criminology as well as other fields. After learning about PTSD, it would be hoped that you could see potential benefits of such training to help treat PTSD symptoms.

What this study shows is that the effect of mindfulness training can be transferrable to situations when people with mindfulness experience are in a non-meditative state (meaning, they're just laying down in the fMRI machine normally).

As you've learned, violence may be a result of a lack of prefrontal cortex function during times of social threat when our amygdala activates in response to the negative emotional stimuli. This increases physiological arousal and readiness to fight, which could lead to people acting violently. Mindfulness training could have potential applications to help people prone to violence by reducing their physiological reactions to emotional stimuli.

The term neuroplasticity can be used to describe any change in the brain's structure, function or activity as a result of experience. The neuroplasticity demonstrated in this study is the change in the neural pathway that has occurred in the mindful group in response to negative emotional stimuli. The perception of the negative emotional stimuli would not be travelling along a neural pathway through the amygdala at the same rate as the other groups. Perhaps a new pathway has been developed whereby the neural pathway perceiving negative emotional stimuli is better connected to the prefrontal cortex, thus reducing total activation of the amygdala.

After learning about some of the potential underlying biological correlates of criminal behaviour, hopefully you can see how studying the origins of behaviour can help us develop more effective strategies to address causes of antisocial behaviour. At the moment a common strategy is to address the symptom, without targeting the cause. This will be another important concept to think about when you learn about treatments for people with psychological disorders such as PTSD.

Guiding Question:

How might the neuroplasticity benefits of mindfulness might be used to reduce violence?

Abstraction Extension:

Research Methodology – External Validity - Sampling – Population Validity: External validity involves being able to abstract a relationship demonstrated in one study and apply it to a wider field. The nature of the sample used in the study might affect the extent to which the findings can be generalized to a wider population because of characteristics of that sample. This is called "population validity". If we are trying to abstract the relationship between mindfulness and reduced amygdala activation in situations with negative emotional stimuli, you need to think about how the participants in the study might be different to those you want to abstract the relationship and apply it to. For instance, this study used healthy volunteers. What characteristics of people prone to violence might influence the extent to which we could expect to get the same results with them?

If you're interested...

There's a fascinating article written in *The Atlantic* by neuroscientist David Eagleman called "The Brain on Trial" that includes the case of Whitman and others to raise questions about culpability and crime. The relationship between neuroscientific findings and their implications in criminal justice is a fascinating field and one I recommend reading more into if you're interested.

There are numerous sources available online that can be used to help you practice mindfulness.

Being able to explain how mindfulness might be applicable to the study of criminology makes for good "discussion" in essays. You probably wouldn't have time to explain these connections in a short answer response (in Paper One, Part A), but you might be able to in essays.

Relevant Topics

- Neuroplasticity
- Conflict prevention strategies

Practice Exam Questions

- Discuss neuroplasticity.
- Explain how and why one research method was used to study neuroplasticity.
- Discuss strategies to reduce conflict.
- **HL:** To what extent are animal models useful for understanding relationships between the brain and behaviour?

Research Methods

Desbordes et al.'s study is a good example of how **true experiments** don't always happen in the laboratory. In this experiment, the participants were randomly allocated to a particular condition and extraneous variables were controlled for. The study was investigating a cause-and-effect relationship between mindfulness training and structural changes in the brain, even though this didn't happen in a laboratory. True experiments in neuroplasticity studies enable the variable of experience to be isolated as a significant factor in structural changes in the brain as a result of experience.

Ethical Considerations

There's an interesting consideration surrounding informed consent in studies where one group will have to experience a condition that is anticipated *not* to have an effect. For example, in some studies testing out the effectiveness of drugs on disorders, there's a control group that receives a placebo. But this means that they are going to be denied a possible treatment for their disorder. Researchers need to consider whether or not to tell them that they might or might not be in one group or the other (to be ethical), but then this has the potential effect of disrupting the results. Similarly, in the mindfulness training in Desbordes et al, three groups are experiencing conditions anticipated not to have an effect. Do researchers inform them that they *may* be in a control group to ensure the study is ethical, or do they not because this jeopardizes validity? Here you can hopefully see that explaining *considerations* doesn't need to involve making *judgments*.

2.8 Genetics and Behaviour

Are people born violent?

(a) Twin and Adoption Studies

Think of something about you that you share with one or both of your parents. For example, an interest, dislike, passion, hobby, fear, personality trait, etc. Do you think you inherited that from your parents biologically, or are you similar in that way because of how you've been raised?

For much of the 20th century, many psychologists argued over the "nature vs. nurture" debate. Is behaviour a product of our genetics, or is it a product of our environment? Do humans think and act the way we do because they were born that way, or because they were raised that way?

Throughout this chapter we've indirectly been discussing this classic debate by investigating how biological, environmental, cognitive and social factors can all interact in aggressive or violent behaviour. Psychologists now generally agree that behaviour cannot be singularly explained by nature or nurture. There is overwhelming evidence that suggests how we think and act is a product of the interaction of environmental and biological factors.

The role of genetics in explaining human behaviour is a popular field of study. Researchers investigate multiple behaviours and their connections with genetics to see if particular behaviours are a result of genetic or environmental factors. Research in this areas regularly comes to the conclusion that *both* genes and environmental factors play a role in behaviour. Research into behaviours like antisocial behaviour, violence, aggression and crime are no different: these studies regularly show that both genetics and the environment can affect these behaviours.

The extent to which a behaviour can be attributed to genetics is called **heritability**. For instance, if a behaviour is 100% a product of our genetics, it is said to have 100% heritability. If it has 40% heritability, this means that the behaviour is 40% genetics and that the environment explains the other 60%.

Studying genetics often involves using twin studies. Twin studies rely on the fact that **identical twins (monozygotic - MZ)** have 100% of their genetic material in common, whereas **fraternal twins (dizygotic - DZ)** have 50% in common. What happens in these studies is that they get a bunch of identical and fraternal twins together and they measure a particular behaviour. For example, they might see how aggressive or violent they are, or their rate of committing violent crimes. What they do is they see how similar the identical twins are to each other, and then calculate this average similarity across *all* the identical twins. Then, they see how similar the fraternal twins are to one another and again calculate the overall average. What the researchers now have are two sets of figures: how similar the identical twins are on average, and how similar the fraternal twins are. They then compare the averages between the identical twins and fraternal twins. The statistical analyses they use to do this are pretty complicated, so we won't go into here. But basically by comparing the average similarity between the identical and fraternal twins, they can determine the heritability of a particular

There is more on **epigenetics** (how the environment and genes interact) in the HL extension on animal studies.

Heritability is the extent to which particular characteristics (e.g. behaviours) are attributable to genetic factors. More specifically, it is the extent to which variability can be attributed to genetics.

The methodology used in twin and adoption studies may take some time to comprehend. It is important that you can describe the process and that you can explain how this process can allow researchers to draw conclusions about the extent to which genetic factors influence behaviour.

behaviour.

Raine and Baker (2007) conducted one such twin study that used 1,210 twins in California, USA. Their particular area of study was **antisocial behaviour** (e.g. bullying, cruelty, stealing, skipping school, etc.) Antisocial behaviour in young children is a good predictor of later criminal activity, which is why studies on children and adolescents are often focused on these types of behaviours.



Genetic similarities between identical and fraternal twins make them valuable sources of data for genetics research.

The researchers gathered data using questionnaires. The child, their teacher and a caregiver (i.e. parent or whoever took care of them at home) filled out a range of questionnaires to test the kids' personalities, behaviours, and social skills. All these were designed to provide a measure of the kids' level of antisocial behaviour. This could then be statistically analysed, making comparisons between fraternal and identical twins and correlations compared. Regardless of which measure they used (the kid's, the teacher's or the caregiver's), the heritability always came at around 50%. The conclusion they drew from this was that antisocial behaviour in these kids was about half a product of genetics and half explained by environmental factors.

One limitation of making conclusions about genetics from twin studies is that perhaps the similarities between the identical twins could be explained because they are treated more the same than fraternal twins, because they look exactly the same. (Raine, 2013) Thus, their environment might be affecting their behaviour in a more similar way than for fraternal twins. For instance, in fraternal twins one might be a boy and the other a girl. Perhaps they are raised differently because of their gender. This might affect the results of studies comparing identical and fraternal twins.

Studying identical twins who have been separated and adopted at birth is one way to isolate the genetics as the variable that's influencing the behaviour. Grove et al (1990) gathered data from 32 sets of identical twins who were separated shortly after being born as they were adopted into different families. Because their genetic material is 100% similar, but their environments are completely different, researchers can use statistical analyses tests to determine the extent to which their antisocial behaviour can

be explained through genetics. They first need to measure their antisocial behaviour by having a range of interviews, tests and questionnaires. Then their scores are gathered and the data are analysed. The results of this study were that the heritability of antisocial behaviour in adults was 28% and 41% in children. This is more evidence that while genetics can influence antisocial behaviour, our environment is still an important influence.

From this research, it is hoped you can see how researchers measure the extent to which genetic factors can explain behaviour. In the next section you will learn about a particular gene that has been correlated with violence.

Guiding Question:

How do studies on twins suggest antisocial behaviour is influenced by genetics and the environment?

Abstraction Extension:

Triangulation: Raine and Baker's study uses data triangulation by combining results from the kids, their caregivers and their teachers. This increases the credibility of the results as it reduces the influence that the individual bias of any one of these people may have on the results. Another form of triangulation is methodological triangulation: getting data by more than one method. How could methodological triangulation be used to further increase the credibility of Raine and Baker's study? What might be the limitations of using this method of triangulation?

If you're interested...

There's a centre in Minnesota that is devoted to studying genetics. It's called the Minnesota Centre for Twin and Family Research. This institute is carrying out two longitudinal studies on thousands of twins. There are multiple studies that they have published and you can read more about their research on their website. One particular field of study of the MCTFR is intelligence. You may be interested to research more about the extent to which IQ is genetics or environment.

Antisocial behaviour is often used in studies investigating early childhood influences in later criminal behaviour. Kids don't usually commit violent crimes such as murder, rape or arson, but if there are higher probabilities that they might if they demonstrate antisocial behaviour as children.

(b) The MAOA “Warrior” Gene

The previous section introduced you to the idea that our behaviour can be a result of genetics as well as our environment.

Due to the work of the **Human Genome Project** researchers are discovering specific genes that can be correlated with specific biological functions and behaviours. Once these genes are found their influence can be investigated; that is to say, they can use the specific gene as a variable in the research and see the relationship between this gene and particular behaviours.

The functions of genes are a very complex biological process. Our focus is partly on the gene, but mostly on how it *might affect behaviour*, since that’s our role as psychologists to understand. So for now let’s focus on one gene called the **MAOA gene**. The MAOA gene has been nicknamed the “warrior gene” because recent studies suggest there is a correlation between people with a variation of this gene and antisocial behaviour. MAOA is an acronym that’s short for **monoamine oxidase A**. Monoamine oxidase A is an enzyme that affects levels of neurotransmitters. The MAOA gene produces the monoamine oxidase A enzyme, but some people have a mutation in this gene so they don’t produce enough of this enzyme, and so the levels of neurotransmitters (e.g. serotonin) in their brain are affected.

However, the combination of genetics and environment cannot be ignored as studies also show that the presence of the variation of the MAOA gene coupled with abuse as a child, increased the likelihood of displaying antisocial behaviours (Caspi et al, 2002). This might explain why not every child that suffers abuse as a child grows up to be violent themselves: perhaps they have a perfectly normally functioning MAOA gene without the mutation, so the abuse may not affect them.

Here’s one key finding about the MAOA gene that can help you solve the problem you were introduced to at the very beginning of this chapter:

Males with a variation of the MAOA gene show greater activity in their amygdala during emotional arousal and they also show less activity in their ventromedial prefrontal cortex compared with people with the normal MAOA gene. (Raine, 2008; Meyer-Lindenberg, 2006).

There’s enough in this chapter to write a whole new book explaining how this might affect our behaviour. The key is to make connections between this new knowledge about the MAOA gene mutation back to what you know about the amygdala, prefrontal cortex, decision making, emotion and situations involving social threat.

So here’s the problem you can now try to solve, drawing on your learning throughout this chapter to help you:

How might a variation of the MAOA gene increase the likelihood of someone reacting aggressively in a socially threatening situation?

If you could take your time and think carefully about this problem, you could easily write an excellent and well-developed answer. But solving this problem might take a good hour, or even three hours. It’s not simple. But the reward you’ll feel when you come up with your own answer to this problem and you have the evidence that clearly supports your explanation will be well worth it. There are many possible answers to this question, which is the purpose of this chapter: providing you with multiple possible explanations for behaviour like aggression, violence and violent crime. Moreover,

you should have enough research and evidence to support your explanations and hypotheses.

Here are a few steps in the problem-solving process that might help you:

1. Identify the problem
2. Identify the key details in the problem
3. Propose a possible hypothesis
4. Test your hypothesis by consulting the evidence (e.g. studies and theories)
 - a. If there is not enough evidence, go back and step two and try again
5. Gather your notes and evidence
6. Organize your notes and evidence and continually make sure you are answering the question
7. Present and discuss your findings.

Answering the question above isn’t going to be easy, but if you take the time to *think* about how it might be answered, your fascination with psychology will flourish.

Guiding Question:

How might a variation of the MAOA gene increase an individual’s probability of being violent?

Abstraction Extension:

Evaluation: If we never move past the *possible* explanations of relationships (e.g. between variations of the MAOA gene and violent crime) we run the risk of making massively erroneous statements like: “people with variations of the MAOA gene will become criminals.” This just simply isn’t the cast: your answer to this section’s guiding question should include an explanation in a very specific context. It is hoped that you can also consider factors that influence the extent to which the relationship between the MAOA gene and violence could be applied to *all* forms of violent crime.

If you’re interested...

Jim Fallon, a neuroscientist, gives a TED talk called “Exploring the mind of a killer.” In this talk he discusses the MOAO gene and how he accidentally discovered that it ran in his family.

You can find a full explanation of how the MAOA-L gene (the variation) might influence behaviour on our blog.

You may be able to hypothesize other explanations for the MAOA gene’s apparent effect on violent behaviour based on your learning from this chapter. For example, could its effect on serotonin levels be a possible explanation for its correlation with antisocial behaviour?

Relevant Topics

- Genetics
- Origins of conflict

Practice Exam Questions

- To what extent do genes influence behaviour?
- Outline ethical considerations related to research on genetics and behaviour?

Research Methods

Questionnaires are valuable methods to gather data from a wide range of samples and are often used as part of **correlational studies**, such as those investigating genetics. Raine and Baker's study used over 1,000 participants. This large sample can increase the probability of generalizability but it would be difficult to gather this data by other methods such as observations. Questionnaires can enable researchers to gather data from huge samples relatively easily. While triangulation can reduce bias, self-report methods like questionnaires always come with the chance of bias.

Ethical Considerations

Any study involving sensitive areas like antisocial behaviour requires informed consent and anonymity. Moreover, **parental consent** is particularly important when studying kids (the cut-off is usually under 16 years old).

Measuring behaviours like antisocial behaviour in kids can also make considerations surrounding **debriefing** rather complex. If, for instance, researchers know of a correlation between antisocial behaviour as a child and the probability of committing more serious crimes later in life, if they found kids had high levels of antisocial behaviour, should they share this with the child and/or their caregiver?

There are many ethical considerations surrounding the applications of findings from genetic studies as well: what if you could undergo genetic testing to find out if you had the MAOA gene: would you want to?

What if behaviour like murder could be sourced to one particular gene: what are the possible implications of making discoveries like this?

Understanding ethics is not always black and white, which is why you need to understand considerations and not just guidelines.

2.9 Social Cognitive Theory

How can nature affect nurture and vice-versa?

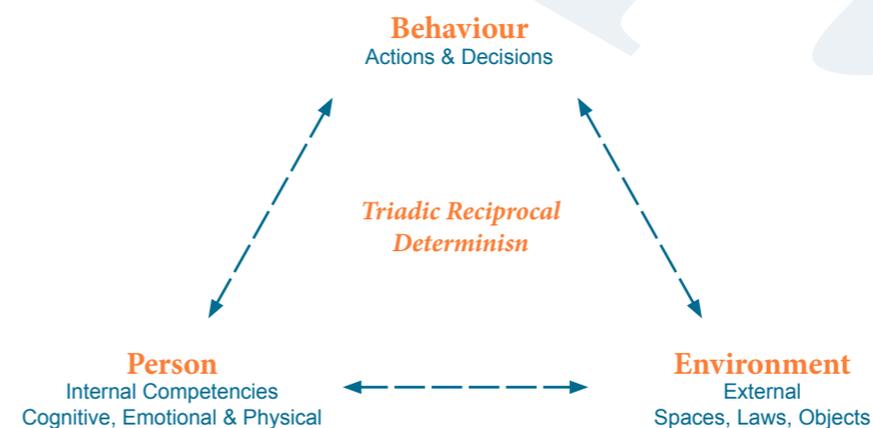
(a) Bandura's Social Cognitive Theory

One of the major goals of this chapter was to help you see how individuals, their behaviour and their environment all interact in complex ways. This is the crux of a theory developed in the 1980s by Albert Bandura called **social cognitive theory**: individuals, their behaviour and their environment all interact. Bandura calls the interaction of biology, behaviour, thinking and our environment, **triadic reciprocal determinism**. Let's take a moment to break down this key term, as it is the heart of social cognitive theory (Bandura, 1989).

Triadic: The key prefix here is tri, or three. SCT composes three variables: the person, the behaviour and the environment. The person includes their beliefs, values, personality, thoughts, etc., as well as their biology (e.g. genes, brain function, hormones, etc.)

Reciprocal: To reciprocate means to return. In this instance it's referring to how behaviours, cognitions, personal factors and environmental influences all influence each other in a **bidirectional** manner. As you will see in the diagram, each factor can influence the other: bidirectionality refers to how an effect can work in both directions. For example, our social environment can affect our behaviour, but our behaviour can also affect our social environment.

Determinism: This refers to the *result* or the *effect*. Each of the three factors may determine another factor.



In short, triadic reciprocal determinism explains how individuals, their actions and their environment all interact. Let's look at some examples:

Cognition → Behaviour: what we think, believe and feel can influence our behaviour. For example, those that believe they should defend their honour when they are insulted will behave differently when they are threatened compared to those that hold no such belief.

Behaviour → Cognition: The results of our behaviour, including rewards, punishments, effects, may affect how we think in the future. For example, if we are rewarded and praised for acting in a tough and aggressive manner, this might lead us to think that this is an acceptable way to act.

Biology → Behaviour: Bandura considers biological factors as part of social cognitive theory as well and these fall within the individual aspect of the triad. We've already seen multiple examples of how our biology can influence our cognition, and how this effect on our cognition can influence our behaviour.

Behaviour → Biology: You learned about how this effect is bidirectional when you studied **neuroplasticity**. In short, repeated thought processes and actions can actually alter the structure and functioning of the brain. So behaviour can lead to changes in the brain, and these changes can in turn affect behaviour.

Environment → Behaviour: The environmental factors is where the “social” aspect of Bandura's theory comes in. By “environment,” he is not just referring to our physical environment, but the effect of social influences as well. Some of these influences including **modelling** (learning by observing others), instruction and **social persuasion** (e.g. peer pressure).

Individual → Environment: This is an interesting direction of causality that few would consider. Characteristics as basic as size, age, gender, or race can affect people's reactions to an individual. These reactions, in turn, could affect a person in many ways. If a child, for instance, is viewed as being a bully or overly aggressive, other children may react differently to them than they would a meeker and more mild-mannered child. These reactions could, in turn, affect the children differently.

Bandura's social cognitive theory is a development of an earlier theory of his which he called social *learning* theory. But whereas SLT focused primarily on the effect of the environment on the individual, SCT is concerned with providing an explanation for how individual, behavioral and environmental factors all interact and influence one-another. As you go through this course, you'll be able to see many examples of Bandura's triadic reciprocal determinism. Moreover, understanding this complex relationship is one of the key ideas that you'll acquire by the end of this course.

Guiding Question:

How can triadic reciprocal determinism be demonstrated in research?

Abstraction Extension:

Supporting Evidence: In the next section you'll have one famous experimental paradigm that Bandura developed to test his social learning theory. Social cognitive theory, however, could be supported by almost *any* study in psychology. Can you find one or two studies that would explain a triadic explanation of behaviour? That is to say, they show how all three factors can be included in the same behaviour?

If you're interested...

Bandura's theories have been applied to many fields, including education and entertainment. Moreover, these fields have been combined whereby TV shows, films, radio programmes and other forms of media are created with the hope of educating whilst entertaining. The APA has an interesting article on this called “The Theory Heard ‘Round the World.”

(b) Study Vicarious Learning and Bandura's Bobo Doll

Before the following experiment is explained it's important to note that this experiment was conducted over twenty years *before* Bandura presented his social cognitive theory. There are numerous studies that we look at throughout this course that could be used to support an explanation of Bandura's triadic reciprocal determinism, which is at the heart of social cognitive theory.

For example, aggression could be explained through the effects of a lack of prefrontal cortex function to regulate impulsive reactions to social threats. In this instance, the behaviour (aggression) is an effect of brain activity (internal) and decision making (also internal) in reaction to the social threat (the environment).

But another key element of SCT is that of **vicarious learning**, which means being able to learn through the observation of others and how they're rewarded or punished for their actions. This was the key claim in Bandura's social learning theory, but SCT was renamed to increase the focus on the internal aspects associated with this learning.

Bandura conducted many experiments in the 1960s to test his ideas regarding the effects of **modelling** on vicarious learning. In these experiments, young children around three to four years old were placed in a room and watched an adult playing with a big inflatable Bobo Doll. In one condition a child watched an adult beating, kicking, hitting with a hammer and generally behaving aggressively towards the doll. In another condition, the kids watched an adult playing nicely with the doll and in the control condition the kids didn't watch any model. The researchers made observations while standing behind double-sided mirrors and counted the number of “aggressive acts” the kids made (like punching, hitting, etc). The results showed that watching the violent adult did in fact lead to an increase in aggressive acts. Those kids that watched the aggressive adult performed more similarly aggressive acts than those that didn't. (Bandura, Ross & Ross, 1963)

In a follow-up study, Bandura replicated this but had four conditions:

- Real life model
- TV Model
- Cartoon Cat Model (the model was dressed up as a cartoon cat)
- Control condition (no observation of a model).

This study was in 1963 when television was becoming really common in American households and Bandura wanted to see if children would be more likely to copy televised aggression (i.e. by watching it on TV) or a model in real life. The adult “model” was told to behave the same as in the first studies, the difference was in how they saw the model. The real life condition was the same as in the original study, but in the TV condition the model was filmed. The cartoon cat version was the same behaviours but the model was dressed as a cartoon cat. Interestingly, the cartoon cat had the most influence on the children's behaviour. All three aggressive model conditions, however, lead to higher aggressive behaviours in the children than the control group.

In both of these studies, and many similar replications, the effect of the social environment (observing a model) on behaviour (aggression) can be witnessed. The children are learning how to behave vicariously through the observation of the model. Other variations of this experimental paradigm involved the children watching an adult being rewarded or punished for their actions. The results of these studies, not surprisingly, was that the imitation of the observed behaviour increased when the children viewed a model who was rewarded for their actions (Bandura, 1971).

Modelling is having someone demonstrate a particular behaviour and then the learner copying. This is one way children learn certain attitudes. While Bandura's theories can be used to explain attitudes and behaviours surrounding aggression and violence, they could also be used to explain other phenomena, like stereotypes, prejudice and discrimination.

While most studies show a relationship between two variables, the whole purpose of the structure and contents of this chapter was to enable you to understand multiple interacting relationships. When explaining social cognitive theory, try to think of a supporting explanation that demonstrate all three points of the triad.



The effect of violent media (including TV) on aggression and antisocial behaviour in children is a long-standing debate with a lot of research on either side.

However, one limitation of the bobo doll studies is there is no measure of internal effects of the modelling. The “cognition” aspect of social cognitive theory is not directly measured in these experiments and can only be inferred. The kids in the Bobo Doll experiments may have been developing attitudes about aggression and violence, including what is acceptable and unacceptable behaviour. One reason why Bandura developed SLT to become social cognitive theory was that he wanted to highlight internal factors in the relationship between behaviour and the social environment.

Bandura’s theories and studies can be used to explain how social factors, such as modelling, can influence our behaviour. This could explain, for example, how the cultural values of the “Culture of Honour” may still be prevalent in modern society: they are passed down from generation to generation through the effects of modelling and other social influences.

Guiding Question:

How do the bobo doll studies demonstrate the effects of the social environment on behaviour?

Abstraction Extension:

Generalizability - Time: In evaluating studies, one key aspect to consider is the time period when they were conducted. Bandura’s early Bobo Doll experiments were conducted in the 1960s. A lot has changed in the past 50+ years. Would you anticipate getting the same or similar results if these experiments were conducted today? A good explanation of generalizability would include explaining specific factors related to time that might affect the reliability of the results. What factors might affect the extent to which we could generalize Bandura’s results from the 1960s to today’s modern kids?

If you’re interested...

Numerous videos, including footage from Bandura’s studies, are available online. One example is an extract from the BBC’s three-part documentary “The Brain: A Secret History.”

Relevant Topics

- Social cognitive theory
- Origins of conflict
- Culture and behaviour

Practice Exam Questions

- Describe social cognitive theory.
- Discuss social and/or biological origins of conflict.

Research Methods

Bandura’s Bobo Doll experiments are examples of how social factors can be isolated and observed under controlled situations in **true experiments**. In his studies he had numerous researchers observe and measure the children’s behaviour quantitatively. By using a matched pairs design, he was also able to reduce the chances that participant variability in traits like aggressiveness would affect the results. The ability to assign participants to conditions randomly or by matched pairs is an important characteristics of laboratory experiments because it can control for extraneous variables, such as participant variability.

Ethical Considerations

When studying children as young as three years’ old there’s obviously **parental consent** to consider. But another ethical consideration is simply taking into consideration the long-term impact the study might have. (When studying ethical considerations, you can simply describe what you think the researchers might have to consider without having to label it with one of the standard guidelines). For instance, could the observation of aggressive models have long-term impacts on the kids? What if they grew up to hate clowns? That’s is perhaps an exaggeration, but it’s still important to consider.

Conclusion

Remember the story of Charles Whitman you heard at the beginning of this chapter? Perhaps go back and re-read the story of Charles. Do the questions or thoughts you have about Whitman change now you've learned a little more about possible correlations of violence?

You didn't hear the whole story. In his letter Whitman writes...

"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. These thoughts constantly recur, and it requires a tremendous mental effort to concentrate on useful and progressive tasks. In May when my parents made a physical break I noticed a great deal of stress. I consulted a Dr. Cochrum at the University Health Center and asked him to recommend someone that I could consult with about some psychiatric disorders I felt I had. I talked with a Doctor once for about two hours and tried to convey to him my fears that I felt come (sic) overwhelming violent impulses. After one session I never saw the Doctor again, and since that I have been fighting my mental turmoil alone, and seemingly to no avail. After my death I wish that an autopsy would be performed on me to see if there is any visible physical disorder. I have had some tremendous headaches in the past and have consumed two large bottles of Excedrin in the past three months."

In fact, an autopsy was performed on Whitman and they found a tumour impacting his amygdala. Could this have influenced his actions? Or was it the excess amount of medication he was consuming? Perhaps it was his high levels of stress, his military training or trauma he may have suffered from the hands of his abusive father.

My hope from this chapter is that you've learnt how our brain can influence our cognition which can influence our behaviour which may influence our brain, but our environment might also influence our brain which could influence our cognition, but the role of emotion plays a part in our behaviour, which is affected by our cognition and our biology, which may be affected by our environment, which may influence other biological factors.....

Don't panic! You do not need to be able to explain the above. The reason the study of criminology (and psychology) is so fascinating, is that the path to understanding a complex human behaviour like violent crime is a complicated one. The study of psychology is about investigating complex relationships and multiple explanations, while continually scrutinizing the evidence used to support such explanations. Humans aren't simple animals, so explanations for our behaviour are rarely simple.

As this is early in your psychology career, all you'll need to do is explain straight forward relationships between two factors, with a possible effect of that relationship. These relationships are the basis of the guiding questions and will be the basis of your exam questions. For instance,

- How can hormones influence behaviour?
- How can neurotransmission influence behaviour?

- How can research demonstrate localization of brain function?
- **HL:** How and why are animal studies used?

If you can answer these questions and use psychological evidence to support your answers, you've taken a huge first step in becoming a great psychologist! And if you're not quite there with all these relationships yet, don't worry – there's plenty of time left in the course. This chapter has provided you with many building blocks of knowledge that will be useful in later chapters.