

# The big picture

## Section

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## ? Subtopic question(s)

During this subtopic, you will be working towards answering the following subtopic question:

- To what extent does my environment dictate my cognition and behaviour?

The guiding questions in each section help to guide you towards answering the subtopic question(s) at the end of the subtopic. The subtopic questions require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Imagine you are at a restaurant ordering takeaway food. There is a long line of people behind you and the person at the counter is waiting for your order. You have a few seconds to decide. What do you choose, and why?

Every day, you make hundreds of decisions. In the restaurant situation, you probably chose what was delicious last time, because it didn't take much thought. Or perhaps the daily special, creatively written on the chalkboard, caught your eye. This quick, intuitive decision is called System 1 thinking and can be explained by the dual process model of cognition. This model holds that System 1 uses past experiences to make quick and intuitive decisions, mainly because it requires less cognitive effort.

These explanations (and many more!) can help us to understand how our environment shapes our decision-making and other cognitive processes (**Figure 1**).



**Figure 1.** Many factors shape our everyday decision-making.

Credit: Hinterhaus Productions, Getty Images



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## 🔗 Making connections

It is important to understand that the dual process model of cognition and learning theories, such as classical conditioning and operant conditioning, have many practical applications.

In [subtopic 2.3 \(/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49450/\)](#), for example, you looked at how behaviourism principles can explain behaviours such as addiction. These same principles can also be applied to change behaviours. For example, aversion therapy, where an addictive substance is paired with an undesirable stimulus, can help people with addictions to overcome their substance addiction. Those recovering from addiction can also be offered rewards for abstinence to help them in their recovery.

Schema theory is also relevant, as all our cognitive learning is ‘filtered’ through our existing cognitive schemas. Part of learning is also assimilating stimuli into our existing schemas as well as augmenting schemas and creating them anew.

As you work through this subtopic, think about the real-world applications of these theories.

## 4 section questions ^

### Question 1

SL HL Difficulty:

What is the name for a cognitive framework, or mental structure, that organises and interprets information based on past experiences and knowledge?

Schema



### Accepted answers

Schema

### Also accepted

Cognitive schema, Schemas

### Explanation

Schemas help individuals process and respond to information efficiently by providing expectations about objects, events or situations.

### Question 2

SL HL Difficulty:

Which of the following best explains how behaviourism explains addiction?

1 Addictive behaviours are learned through reinforcement and conditioning.



2 Addiction develops due to unconscious conflicts and repressed desires.

3 Addiction occurs when our schemas become permanently altered.

4 People with addictive behaviours have a genetic predisposition that determines their actions.

### Explanation

When a person engages in addictive behaviours, such as smoking or gambling, they may experience positive reinforcement (such as pleasure or stress relief) or negative reinforcement (such as escape from withdrawal symptoms). Over time, these rewards strengthen the behaviour, making it more likely to continue. Classical conditioning can also create associations between environmental cues (such as seeing a cigarette kiosk or a casino) and cravings, further reinforcing the addiction.



Student view

### Question 3

SL HL Difficulty:

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Name the application of classical conditioning principles, which is used to help people overcome addiction, in which the addictive substance is paired with an unpleasant stimulus (such as nausea).

1 Aversion therapy



2 Operant conditioning

3 Contingency management

4 Cognitive behavioural therapy

### Explanation

Aversion therapy applies the principles of classical conditioning to help overcome addiction to substances, whereby a substance is paired with an unpleasant stimulus. Eventually, an individual associates the substance as being unpleasant.

### Question 4

SL HL Difficulty:

Name the application of operant conditioning principles, used for treating substance-use disorders or encouraging healthy habits, in which desired behaviours are reinforced with rewards or incentives.

1 Contingency management



2 Aversion therapy

3 Classical conditioning

4 Cognitive behavioural therapy

### Explanation

Contingency management is a behavioural therapy technique that uses the principles of operant conditioning to modify behaviour by systematically reinforcing desired behaviours with rewards or incentives.

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5. Learning and cognition / 5.1 Thinking and learning

# How does the dual process model explain cognition?

A-1: Bias    B-4-1-4: Describe the role of the dual processing model for understanding thinking and decision-making.

B-4-2-5: Describe one or more strategies to improve one or more cognitive processes.

B-4-4-1c: (HL) Discuss the extent to which learning and cognition across cultures is similar and different.

C-2-4: Describe the role of one or more cognitive models in understanding a cognitive process or behaviours.

C-2-5: Describe the role of the dual processing model in understanding decision-making.    C-2-7: Describe the role of anchoring bias in decision-making.

C-2-8: Describe the role of confirmation bias in decision-making.

Notebook



Glossary



## Teacher instructions

### Learning outcomes

- Describe the role of one or more cognitive models in understanding a cognitive process or behaviours.
- Describe the role of the dual processing theory in understanding decision-making.
- Discuss how the dual processing theory of thinking and decision-making can provide an explanation for cognitive biases.
- Describe the value of the dual processing theory for understanding thinking and decision-making.
- Describe one or more strategies to improve one or more cognitive processes.
- Describe the role of anchoring bias in decision-making.
- Describe the role of confirmation bias in decision-making.

### HL Extension

- Discuss the extent to which learning and cognition across cultures are similar and different.

### Facilitation guidance

In this section, students will learn about the dual process model of thinking and decision-making. They will learn to differentiate between System 1 and System 2 thinking. They will discover how each system operates, explore examples in real-life decision-making, and reflect on the role of biases and cognitive processing in shaping their judgements.

### Guiding question(s)

In this subtopic, you will think about the question, '**To what extent does my environment dictate my cognition and behaviour?**' This section will help you make an informed response by working through the following guiding question:

- How does the dual process model demonstrate reduced cognitive control?

At this point, the existence of cognitive biases is a well-researched area of psychology. This section will introduce you to the dual process model of thinking and decision-making, and allow you to explore some of the research that has established cognitive biases. You will consider what evidence there is to support the existence of cognitive biases.

The guiding questions in each section help to guide you towards answering the subtopic question(s) at the end of the subtopic. The subtopic questions require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

 Student view



## Dual process model

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A bat and a ball together cost \$1.10. The bat costs \$1 more than the ball. How much does the ball cost? (Read on to find out!)

According to psychologists, there are two distinct ways in which humans make decisions. This dual process model of thinking and decision-making is a framework that has been developed and refined over the past 50 years by psychologists, including Paul Slovic, Tversky and Kahneman, and Stanovich and West. This model of cognition suggests that thinking can be categorised into two systems, or types of thinking, known as System 1 thinking and System 2 thinking.

You most likely used System 1 thinking to solve the bat and ball problem. As a result, you likely concluded that the ball costs 10 cents. This answer, however, is wrong. The correct answer is actually 5 cents: a bat costs \$1.05 and, since a bat is \$1 more than a ball, the ball must cost 5 cents ( $\$1.05 + \$0.05 = \$1.10$ ).

System 1 thinking is fast, automatic and intuitive. You have developed this system based on your experiences. Your experience doing math subjects at school has helped you utilise System 1 thinking for very simple equations, such as  $1 + 1 = 2$ . You probably did not even have to think about it, as System 1 thinking operates with very little effort, even unconsciously.

Interestingly, if you had been asked a more complex mathematical problem, such as  $2 \times (36 \times 3)$ , you likely would have given the correct answer, because you would have taken the time to determine the solution, using System 2 thinking. System 2 thinking requires effort and conscious control. System 2 thinking is engaged in complex problem-solving, logic and reasoning, such as solving complex mathematical equations.

These systems differ in their capacity for processing information.

### System 1 thinking

System 1 has a high capacity for processing information, meaning that it can handle a large volume of inputs at the same time, and operate efficiently. For example, imagine you are walking through a busy school hallway between classes. Without consciously thinking, you can recognise your friends' faces, notice if someone is moving towards you and step aside to avoid a collision, and hear snippets of conversations around you. System 1 works quickly, allowing rapid responses in complex situations.

System 1 makes use of heuristics, which are mental shortcuts that help us make decisions based on generalisations and past experiences. Heuristics draw upon our existing schemas to make quick judgements without analysing every detail. Heuristics are useful for avoiding cognitive overload and reaching reasonable conclusions to complex problems in a limited amount of time.



### Perspective lens

#### Biological approach

Evolutionary psychologists examine human behaviour using a biological approach. They seek to understand human behaviour from an evolutionary psychological perspective, asking, 'how might this behaviour benefit the individual organism?' or 'how might this behaviour have emerged as a consequence of another behaviour?'



#### Reflection question

Consider the following scenario:



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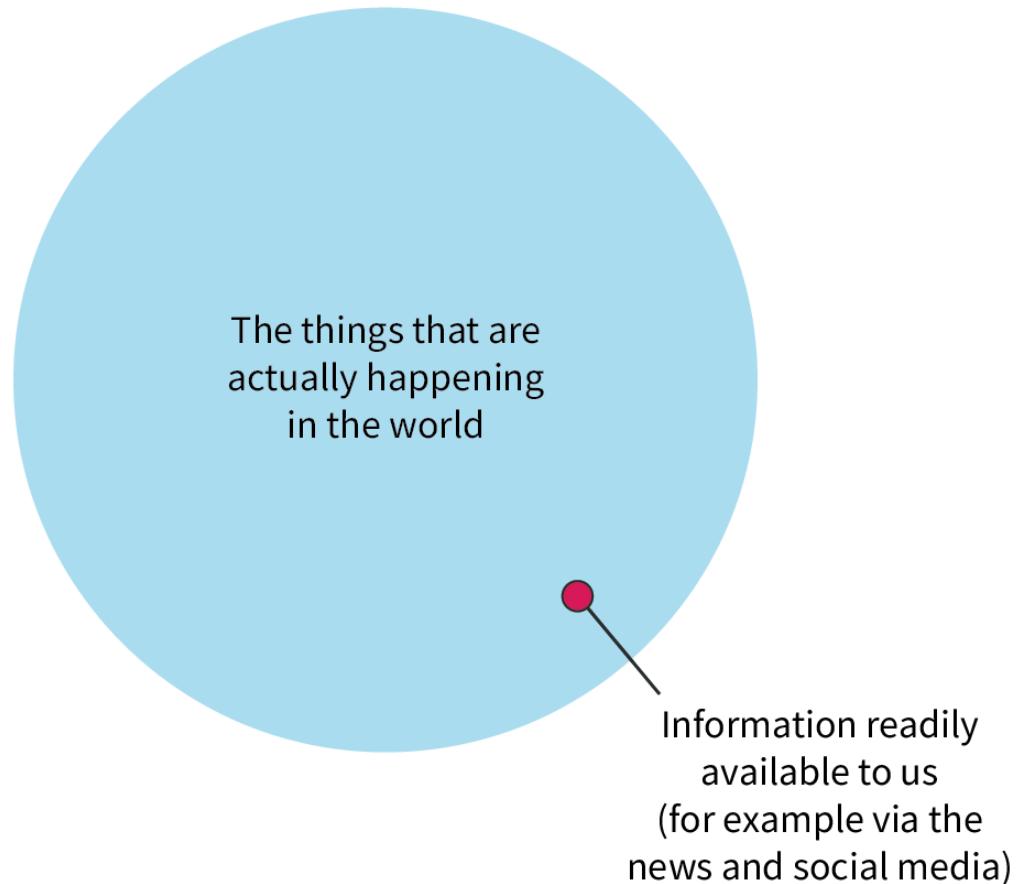
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You are about to cross the street, and a car comes speeding down the road, so you automatically step back. This can be attributed to System 1 thinking.

1. How might a psychologist studying the dual process model of thinking explain its origin from an evolutionary perspective?

It is important to understand that heuristics can be problematic and lead to incorrect judgements or cognitive biases. For example, the availability heuristic is a mental shortcut where people judge the likelihood or frequency of an event based on how easily examples of it come to mind (**Figure 1**). So, for example, a person might think that shark attacks are common because they recently heard about an attack in the news. However, shark attacks are extremely rare. People may overestimate the probability of dramatic but rare occurrences as a result of a reliance on heuristics.



**Figure 1.** The availability heuristic.

More information for figure 1

A large circle represents the things that are actually happening in the world. A much smaller circle inside it represents information readily available to us, for example, via the news and social media.

## System 2 thinking

In contrast to System 1, System 2 has a limited capacity for information. It can only process a few pieces of information at once as it requires more cognitive resources. Because of this, System 2 generally is more accurate and less prone to error than System 1. However, System 2 requires a lot more mental energy and focus as it results in more rational thinking. Humans are ‘cognitive misers,’ a term first introduced by Fiske and Taylor in 1984, which suggests that humans conserve mental effort by relying on simpler, less effortful cognitive processes whenever possible. Hence, engaging System 2 thinking can help overcome these tendencies. However, this requires motivation and sufficient cognitive resources (**Interactive 1**).



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## System 1 thinking   System 2 thinking

Slow	Fast
Automatic	Deliberate
Intuitive	Analytical
Effortful	Effortless
Error-prone	Error-correcting
Independent of context	Context-dependent
Rule-based	Heuristic-based

Check

**Interactive 1.** Sort each characteristic into either System 1 or System 2 thinking.

## Concept

### Bias

There are over [200 known biases](https://www.sciencedirect.com/topics/neuroscience/cognitive-bias) (<https://www.sciencedirect.com/topics/neuroscience/cognitive-bias>), with some common biases, including confirmation bias and anchoring bias.

### Reflection question

1. Based on your understanding of the dual process model so far, explain how the model explains the existence of biases, such as the ones in the list of 200 types.

## International mindedness

Biases, often a result of System 1 thinking, play a role in how we perceive and interact with people from different backgrounds. When we encounter people from different cultures, our System 1 responses might lead us to make quick judgements based on limited information, which can inadvertently reinforce biases.

To nurture international mindedness, it is important to actively engage System 2 thinking when learning about or interacting with people from other cultures.

### Reflection question

1. In what ways can cultural assumptions be challenged to foster international mindedness?



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## The interaction between System 1 and System 2

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It is important to note that these two systems are not independent of each other. These two systems interact dynamically to influence human cognition. System 1 is generally the default mode of thinking, operating quickly and automatically. System 2 is generally considered to oversee System 1. However, it still allows many intuitive judgements to pass through — some of which may be inaccurate.

For example, consider the answer to this question: Tom is a big fan of 20th-century literature, wears glasses and is 5 feet 7 inches (170cm) tall. Is it more likely that Tom is a truck driver or an English professor at a university?

Your intuitive judgment, using System 1 thinking, is that Tom is an English professor since he matches the stereotype of an English professor. This happens automatically because of the representativeness heuristic, a cognitive shortcut where an individual judges the probability of an event based on how well it matches their existing stereotypes or schemas. However, it is statistically more likely that Tom is a truck driver, as there are far more truck drivers than English professors. If you engage your System 2 thinking and use logical reasoning, you can override your intuitive judgement.

In their 2011 study (https://doi.org/10.1016/j.cognition.2010.09.012), researchers Diemand-Yauman, Oppenheimer and Vaughan investigated whether presenting educational materials in a disfluent (hard-to-read) format can enhance learning and retention by activating System 2, and therefore prompting deeper cognitive processing. In a controlled laboratory setting, participants were asked to learn information about a fictional alien species presented in either a fluent (easy-to-read) or disfluent font. Participants who studied materials in disfluent fonts demonstrated better retention and recall compared to those who studied fluent materials. These findings suggest that introducing disfluency to learning materials can serve as a ‘desirable difficulty,’ leading to deeper processing and improved memory performance. Disfluency prompts a shift from automatic, intuitive processing (System 1) to more effortful, deliberate processing (System 2).

Several factors influence the interaction between System 1 and System 2 thinking.

- When our cognitive load is high, there is a greater reliance on System 1 thinking.
- When we are unmotivated or fatigued, we may rely more on System 1, even if deeper thought is required.
- Expertise can also play a role. Some experts, such as doctors, may use System 1 thinking for fast, intuitive thinking informed by their training, and System 2 only steps in for complex cases.

The interaction between the two systems allows individuals to balance efficiency and accuracy.

### HL Extension

#### Culture

### The extent to which learning and cognition across cultures is similar and different

The applicability of the dual process model to all cultures is debated. The model has strong support in Western cultures, but the universality of the model can be questioned.

Nisbett et al. (2001) (https://doi.org/10.1037/0033-295x.108.2.291) suggest that Western cultures (for example, Germany, Canada) tend to emphasise analytic thinking (System 2), where decisions are based on rules and logic. However, East Asian cultures (for example, South Korea, Japan) often favour holistic thinking, relying more on intuition, context and social harmony, which may align more with System 1.

So, while the two systems of thinking exist cross-culturally, they may not fully capture cultural differences in thinking.



## Reflection question

1. Based on Nisbett et al.'s research and the information contained within this section, do you think that dual process thinking is a product of culture, or do you think it is a universal feature of being human? Be sure to provide a clear and complete explanation for your response.

# Evaluating the dual processing model

The dual process model of cognition provides a framework for understanding everyday decision-making. It helps explain why people often make quick, intuitive decisions in some situations, and deliberate, logical decisions in others. This model has been applied in psychology, education, economics and behavioural sciences to help us understand judgements, reasoning and decision-making.

The model is not without its limitations. It has been criticised for being overly simplistic: dividing thinking into strictly two categories may neglect other forms of cognition and the complexity of thinking. Some cognitive processes may not be able to be categorised into these two systems [\(https://doi.org/10.1093/oxfordhb/9780199730018.013.0014\)](https://doi.org/10.1093/oxfordhb/9780199730018.013.0014). Furthermore, the mechanisms and interactions between the two systems are seen as vague [\(https://doi.org/10.1177/1745691613483774\)](https://doi.org/10.1177/1745691613483774), meaning that the model may lack predictive power. It does not specifically predict when, how and why people switch between System 1 and System 2 in different situations.

### Teacher instructions

## Goals

- Describe the role of the dual processing model in understanding decision-making.
- Evaluate the value of the dual processing model for understanding thinking and decision-making.

## Facilitation guidance

To make the activity more interactive, ask students to create cards with a scenario on each. Students will then sort these into System 1 or System 2. The goal is for students to have difficulty sorting the cards into two piles. They should realise that thinking is not purely System 1 or System 2, and that we do not necessarily choose which system we use.

### Activity

IB learner profile attribute: Thinkers/Reflective/Inquirers/Open-minded

Approaches to learning: Thinking/Research

Time required to complete activity: 30 minutes

Activity type: Group

## The decision challenge

In small groups, complete the following tasks:

1. Write the scenarios on separate cards.
2. Discuss each 'decision scenario' and associated question.
3. Then, sort each 'decision scenario' card into one of two piles:
  - a. when you would most likely use System 1 thinking
  - b. when you would most likely use System 2 thinking.



#### 4. Have a representative from your group share your responses.

Scenarios:

- A. You are three-quarters of the way through a multiple-choice question exam, and you are running out of time. Which system do you think you will use for the remainder of the exam?
- B. You are offered two internships, one close to home with decent pay, and one far away but with a prestigious company. Which system do you think you will use to make the decision? Why?
- C. You are walking through an electronics retail store. You have saved money for months to buy a new phone, but now you see there is a new laptop you would like. Which system do you think you will use to make the decision? Why?
- D. You are looking for a gift for a friend. You find something nice but it is a bit expensive. Which system do you think you will use to make the decision? Why?
- E. You are at a fast-food restaurant, and the person at the counter is waiting for your order. You have a few seconds to decide. Which system do you think you will use to make the decision? Why?
- F. You are driving somewhere familiar, but there is heavy traffic on your usual route. Do you take a detour or stay on the road you know? Which system do you think you will use to make the decision? Why?

### Reflection questions

As a group, discuss the following:

1. Were there any instances when it was hard to decide whether System 1 or System 2 was more likely to be used?
2. What are some benefits of using System 1 in certain situations? What about System 2?
3. Were there any scenarios where switching between the two systems might be beneficial? Why? Why not?
4. **(Concept application: bias)** In which scenarios might relying too heavily on System 1 thinking lead to biases? How can awareness of System 1 help you avoid these biases?

### Learning outcomes

By the end of this section, you should be able to:

- Describe the role of one or more cognitive models in understanding a cognitive process or behaviours.
- Describe the role of the dual processing theory in understanding decision-making.
- Discuss how the dual processing theory of thinking and decision-making can provide an explanation for cognitive biases.
- Describe the value of the dual processing theory for understanding thinking and decision-making.
- Describe one or more strategies to improve one or more cognitive processes.
- Describe the role of anchoring bias in decision-making.
- Describe the role of confirmation bias in decision-making.

### HL Extension

- Discuss the extent to which learning and cognition across cultures are similar and different.

## 3 section questions ^

### Question 1

SL HL Difficulty:



What is the term for mental shortcuts, or 'rules of thumb,' that people use to make decisions and solve problems quickly and efficiently?



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**Accepted answers**

Heuristics

**Explanation**

Heuristics are a key feature of System 1 thinking, which is fast, automatic and intuitive. System 1 relies on heuristics to process information quickly without the need for detailed analysis

**Question 2**

SL HL Difficulty:

- System 1 thinking is effortless, fast and intuitive, whereas system 2 thinking is slow, effortful and rational.

**Accepted answers and explanation**

#1 1

#2 2

**General explanation**

According to the dual process model of thinking and decision-making, System 1 thinking is fast, effortless and intuitive, relying on heuristics, while System 2 is slow, effortful and rational, requiring conscious effort.

**Question 3**

SL HL Difficulty:

Which of the following is a limitation of the dual process model of thinking and decision-making?

- 1 It oversimplifies complex cognitive processes by categorising them into only two systems.
- 2 It accurately explains how biases occur in decision-making.
- 3 It provides detailed neural mechanisms underlying cognitive processes.
- 4 It emphasises the importance of System 1 in logical reasoning.

**Explanation**

While the model provides a useful framework for understanding thinking and decision-making, it simplifies the dynamic nature of cognitive processes into two broad categories: System 1 and System 2.

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5. Learning and cognition / 5.1 Thinking and learning



(https://intercom.help/kognity)



# How does the environment impact our cognition?

A-2: Causality    B-4-1-4: Describe the role of the dual processing model for understanding thinking and decision-making.

C-2-5: Describe the role of the dual processing model in understanding decision-making.    C-2-7: Describe the role of anchoring bias in decision-making.

C-2-8: Describe the role of confirmation bias in decision-making.

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## Teacher instructions

### Learning outcomes

- Describe the role of the dual processing theory in understanding decision-making.
- Discuss the application of social learning theory to explain and change behaviour.
- Describe the role of anchoring bias in decision-making.
- Describe the role of confirmation bias in decision-making.
- Discuss the extent to which one could claim that all cognition is caused by the environment.
- Describe the value of the dual processing theory for understanding thinking and decision-making.

### Facilitation guidance

In this section, the focus is on the role of biases and their effect on cognition. Students will learn what cognitive biases are, how they influence thinking and behaviour, and how they can lead to errors in judgement. They will identify examples of common biases (for example, confirmation bias, availability bias and anchoring bias) and explore methods for recognising and minimising bias in their own thinking.

### ? Guiding question(s)

In this subtopic, you are thinking about the question, ‘**To what extent does my environment dictate my cognition and behaviour?**’ This section will help you make an informed response by working through the following guiding question:

- What factors impact my cognition?

This section will focus on environmental factors that impact cognition, such as schemas and other environmental stimuli. In this section, you will explore the impact of biases originating in the environment, including, but not limited to, the availability heuristic, representativeness heuristic, anchoring bias and mere exposure effect.

The guiding questions in each section help to guide you towards answering the subtopic question(s) at the end of the subtopic. The subtopic questions require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

## The role of cognitive biases in decision-making

Have you ever noticed how you tend to believe the first thing that comes to your mind, even when a little extra thought could prove you wrong? System 1 thinking, which you learned about in [section 5.1.1 \(/study/app/psychology-new/sid-540-cid-763690/book/section-name-to-follow-id-49812/\)](#), helps explain why this occurs. When engaged, System 1 thinking relies on heuristics. Although heuristics are not always problematic (they help reduce our cognitive effort, allowing us to dedicate more resources to other tasks), these mental shortcuts can sometimes lead to cognitive biases. These biases are systematic errors in our thinking that often result in irrational or flawed decisions.



## Theory of knowledge

### Is bias inevitable in the production of knowledge?

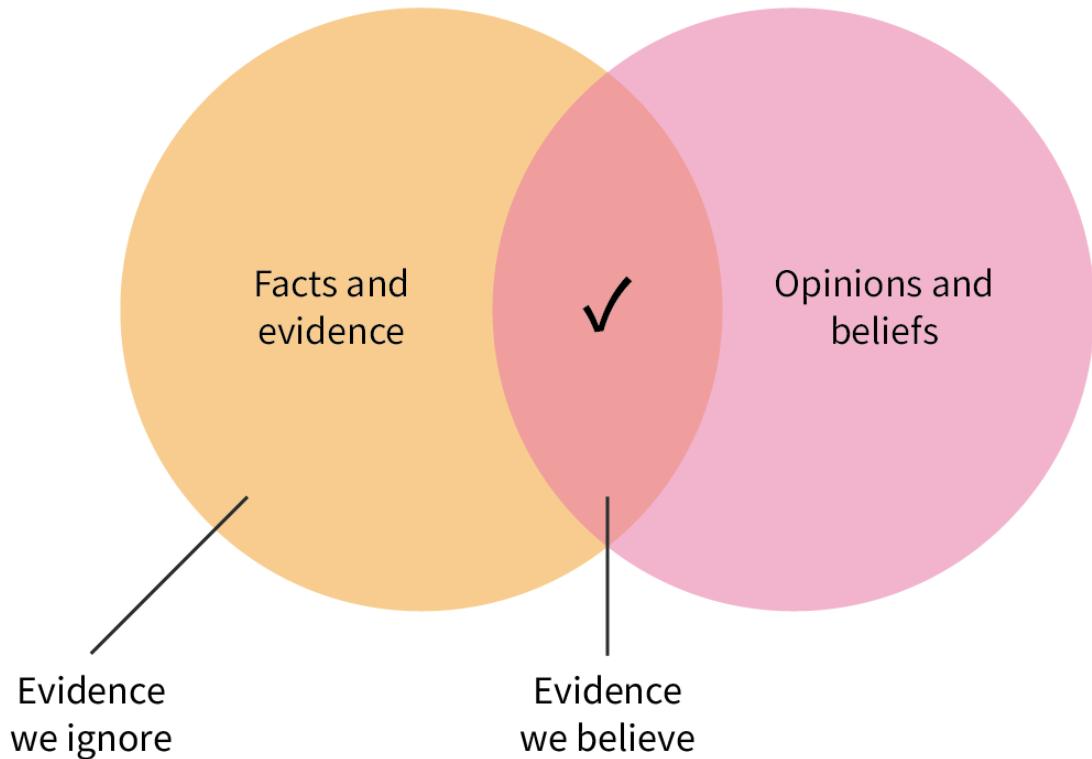
Throughout this subtopic, you will explore the presence of biases in our thinking and decision-making, and how we can overcome these biases. As you explore the subtopic, consider the question, 'Is bias inevitable in the production of knowledge?'

### Confirmation bias

One common bias is confirmation bias. This bias causes individuals to favour information that aligns with their pre-existing beliefs or opinions, whilst disregarding information that contradicts them. For example, an individual may believe that running is the best kind of exercise in comparison to other forms of exercise, such as weightlifting. They therefore conduct research on the benefits of running and ignore any information that demonstrates the benefits of weightlifting.

So, why does this occur? Principally because we are exposed to an overwhelming amount of information daily. It would be nearly impossible for us to have the time and resources to evaluate every piece of information critically. Therefore, our focus on the information that supports our beliefs reduces our cognitive load and simplifies our decision-making process. Additionally, we tend to feel uncomfortable when we hold contradictory beliefs, known as cognitive dissonance. In order to avoid this discomfort, we favour information that reinforces our beliefs (**Figure 1**).

Confirmation bias can make us highly susceptible to misinformation: we may accept false narratives (otherwise known as 'fake news') due to selective exposure. This limits our exposure to diverse viewpoints and even factual information that can challenge assumptions. The latter is particularly prevalent in areas like public health (the field of science and practice that focuses on the health of communities and populations), and this can have negative impacts.



**Figure 1.** Confirmation bias results in individuals seeking out information that confirms their pre-existing beliefs and opinions.

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Venn diagram with two circles labelled facts and evidence on the left and opinions and beliefs on the right. The overlap between them is marked with a tick. The label evidence we believe points to the overlap. The label evidence we ignore points to the part of the left-hand facts and evidence circle that does not overlap with the right-hand opinions and beliefs circle.

Confirmation bias can easily be avoided. However, this is mainly through being aware of its existence through education. [Piksa et al. \(2024\) ↗ \(https://doi.org/10.3389/fpubh.2024.1414864\)](https://doi.org/10.3389/fpubh.2024.1414864) explored whether educating individuals about confirmation bias could reduce their vulnerability to false information. In an online experiment with 1 479 participants, half received information about confirmation bias, while the other half did not. Results showed that those informed about confirmation bias were less likely to accept fake news, indicating increased resilience to misinformation. This effect was especially notable among participants who initially held negative attitudes toward COVID-19 vaccinations. The study suggests that raising awareness of cognitive biases (such as confirmation bias) can enhance critical thinking and improve the ability to discern between true and false information.

## HL Extension

### Q Technology

Confirmation bias, the tendency to seek out information that confirms our existing beliefs, is a prominent bias in thinking and decision-making. Technology may promote this bias. Modern algorithms in technology may have a ‘filter bubble effect.’ In this ‘bubble,’ users are exposed primarily to information and viewpoints that they already agree with, and not information that offers a wider perspective. This can amplify the effects of confirmation bias by making it easy to avoid information that contradicts one’s views.

However, [Ekström et al. \(2022\) ↗ \(https://doi.org/10.1016/j.chbr.2022.100226\)](https://doi.org/10.1016/j.chbr.2022.100226) suggest that we also create our own filter bubbles by choosing to look at and click on information that we already agree with.

Ekström et al. tested this by showing 48 people search results about political topics. They used eye-tracking technology (which measures and records eye movements) to see which links people looked at the most and which ones they clicked on. They found that:

- people spent more time looking at and clicking on links that matched their own opinions.
- people with right-wing (conservative) views were even more likely to do this than people with left-wing (liberal) views.
- people also avoided clicking on sources they thought were not trustworthy.

This means that even if a search engine shows a mix of different opinions, people might still choose to read only what they agree with.

## Application

Using a common search engine, conduct a search on a current relevant topic (such as, AI in education, climate change regulations).

1. Look at the first 10 results and note down the sources. Which ones do you feel drawn to click on?
2. Do these sources match your pre-existing beliefs?
3. How can you ensure that you are exposed to a broader range of perspectives in the future?
4. To what extent should search engines be responsible for encouraging diverse viewpoints?

Present your findings to the class on one or two slides.



## Anchoring bias

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Another prominent bias that can arise as a result of System 1 thinking is anchoring bias. When we face uncertainty, we may rely too heavily on the first piece of information received when making decisions or judgements. This is a way of simplifying our decision-making process. The first piece of information is the ‘anchor,’ and decisions or evaluations are then made based on this (**Figure 2**). For example, if you see a designer-brand shirt for sale for \$150, you may then perceive the same shirt priced at \$100 as inexpensive, even if it is still quite expensive. The \$150 price serves as the ‘anchor’ in this situation.

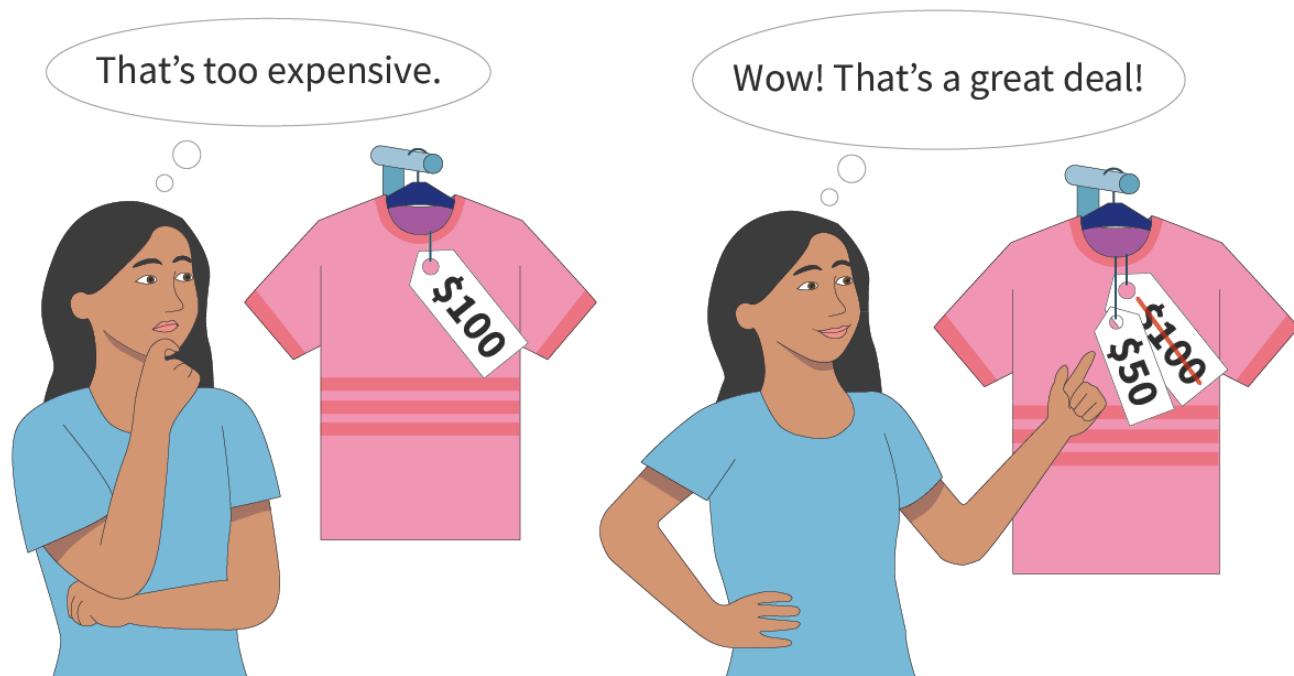
Some people may be more susceptible to anchoring bias than others. Mood, experience and even personality have been demonstrated to impact anchoring bias. [Englich and Soder \(2009\)](https://doi.org/10.1017/S1930297500000693) (<https://doi.org/10.1017/S1930297500000693>) found that individuals in a negative mood were less likely to correctly adjust from the anchor than those in a positive mood. [Caputo \(2014\)](https://doi.org/10.1504/IJMDM.2014.058470) (<https://doi.org/10.1504/IJMDM.2014.058470>) found that individuals with high values in agreeableness and openness to experience were less susceptible to anchoring bias, indicating that being more receptive to new information can help tackle anchoring bias. [Through many research studies](https://doi.org/10.1016/j.soec.2010.10.008) (<https://doi.org/10.1016/j.soec.2010.10.008>), anchoring has been shown to have a large influence in many areas, including the legal system, performance judgements, purchasing decisions, negotiations and even self-efficacy.

[Ly et al. \(2023\)](https://doi.org/10.1001/jamainternmed.2023.2366) (<https://doi.org/10.1001/jamainternmed.2023.2366>) explored how anchoring bias can affect doctors' decisions. Researchers studied data from US Veterans Affairs emergency rooms from 2011 to 2018. They wanted to know if writing ‘congestive heart failure (CHF)’ in a patient’s visit notes affected how doctors tested for pulmonary embolism (PE) in patients with shortness of breath (SOB).

They found that, when CHF was mentioned, doctors:

- were less likely to test for PE.
- took longer to start PE testing.
- were more likely to test for CHF-related problems instead.

This suggests that doctors might rely too heavily on early information, potentially delaying important diagnoses.



**Figure 2.** Anchoring bias means that we base our judgements and decisions on the initial piece of information received.



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A woman looks at a t-shirt with a price tag of 100 dollars. She looks unsure and the thought bubble reads That's too expensive. The same woman then looks at an identical t-shirt with a tag showing a reduction from 100 to 50 dollars. She smiles and thinks Wow! That's a great deal!

So, how do we reduce the effects of anchoring bias? Using multiple sources or conducting further research can help reduce anchoring effects. For example, if you are buying a new t-shirt, you could look at a variety of retailers to see how much the t-shirt is really worth. Engaging System 2 thinking and evaluating your own decision-making, by asking yourself how you came to a particular decision, might help you identify instances of anchoring bias.

Anchoring and confirmation bias are just two biases from over 200 identified. Some other common biases that affect everyday decision-making include:

- **Representativeness heuristic** – judging the likelihood of an event or situation based on how similar it is to a prototype, often leading to neglect of actual probabilities. For example, assuming someone is a librarian because they match stereotypes, despite statistical rarity.
- **Framing effect** – people's decisions can be influenced by how information is presented. For example, a doctor presents options for treatment, saying that one has a 90% survival rate, compared to the other, which has a 10% mortality rate. Despite indicating the same outcomes, the first option is more likely to be chosen because it is framed more positively.
- **Mere exposure effect** – the tendency to develop a preference for things simply because they are familiar, as repeated exposure increases positive feelings toward a stimulus, even without conscious awareness. For example, seeing a particular brand of soft drink repeatedly in TV advertisements, billboards and social media ads may make someone prefer it over other brands, because it feels more familiar.

## Concept

### Causality and measurement

So far in this subtopic, you have explored environmental factors that affect our cognition, such as biases. However, this may be an oversimplification of very complex processes. There may be other factors that influence our cognitive processes, such as our biology.

It is challenging for researchers to design experiments that can directly measure the causal relationship between a given 'bias' and a cognitive or behavioural outcome.

### Reflection question

1. To what extent can experiments on anchoring and confirmation bias assess the cause of environmental stimuli on our decision-making? When answering, be sure to include a consideration of ecological validity.
2. How do the issues of ecological validity affect the extent to which researchers can draw causal conclusions?
3. To what extent could one claim that environmental factors cause cognitive processes?

While there is a large amount of research supporting the existence of biases in our thinking and decision-making, this research does face several key limitations.

- Many studies lack ecological validity, meaning that the research tends to use simplified tasks in laboratory settings and may not accurately reflect real-world cognitive processes.
- These tasks have low mundane realism, meaning that they do not represent real-life situations.

- Many studies tend to focus on biases and heuristics being negative and erroneous, rather than situations where heuristics may lead to accurate or effective decisions.
- There are also individual differences that may be overlooked – factors like personality, mood and expertise can influence an individual's susceptibility to biases, meaning that the conclusions of research on biases may be overgeneralised.

## Strategies for improving cognition

So you may be wondering at this point, ‘how do I get off my System 1-based autopilot and engage System 2?’ It’s a good question, and one that is the focus of much psychological research within the context of thinking and learning. One way you can engage System 2 more frequently is by slowing down your response time. You can slow your thinking through taking a more ‘mindful’ approach to thinking and decision making, but we can also have our thinking slowed by the environment.

Alter et al. (2007)  (<https://doi.org/10.1037/0096-3445.136.4.569>) (<https://doi.org/10.1037/0096-3445.136.4.569>) investigated the impact of ‘disfluent’ (hard to read) fonts on cognition. They hypothesised that, if a logic problem was given in a hard-to-read font, the participant would literally need to ‘slow down’ and therefore would engage System 2. This could be measured by comparing the rates of correct responses to the problem in a disfluent font and the correct response rate in the fluent font. The researchers found that there was a higher correct response rate in the disfluent font condition.

Keysar, Hayakawa and An (2012)  (<https://doi.org/10.1177/0956797611432178>) investigated whether or not the framing effect could be reduced through proposals given in participants’ second languages. The researchers hypothesised that by providing information in a second language, participants would need to translate the information to their native language and as a result ‘slow down’ their thinking.

Similar to Alter et al., the researchers found that the framing effect practically disappeared when choices were presented in a foreign language.

### Teacher instructions

### Goals

- Explain the role of one or more cognitive biases in decision-making.
- Describe one or more strategies to improve one or more cognitive processes.

### Facilitation guidance

Students will apply their understanding of cognitive biases, and extend their understanding to different biases, using The Decision Lab website as well as examples in their own lives.

### Activity

IB learner profile attribute: Thinkers/Inquirers/Knowledgeable

Approaches to learning: Research/Thinking

Time required to complete activity: 60 minutes

Activity type: Pairs



## Bias detectives

### Concept application: Bias

In pairs, investigate the following scenarios.

- A. Yasmin reads online reviews only from sources that confirm her belief that organic food is healthier.
- B. Jad is shopping for a new outfit and sees a designer t-shirt priced at \$100. Later, he sees the same t-shirt priced at \$60 elsewhere and decides to buy it, even though he only wanted to spend \$40 on a t-shirt.
- C. After hearing about a plane crash, Pablo decides not to fly, believing air travel is unsafe, despite statistics showing otherwise.
- D. After failing a test, Reem thinks she 'knew all along' that she should have studied more.
- E. Mikael is more likely to buy a skincare product labelled as '95% natural ingredients' than one labelled '5% synthetic ingredients.'

For each scenario:

1. Identify the bias. Then, visit [The Decision Lab ↗](https://thedecisionlab.com/biases) (<https://thedecisionlab.com/biases>) to check whether your assessment is correct.
2. Use The Decision Lab website to learn about the biases identified.
3. Answer the following questions for each bias:
  - How does this bias affect one's thinking?
  - Identify another example of this bias, either in the media or from your own life experiences.
  - How could you counteract this bias in your own life?

Choose **one** bias to focus on. Present your findings to the class in a 'public service announcement' style video, no more than three minutes long. This is a short, educational video that aims to create awareness and/or change attitudes about an issue (in this case, biases). Your video should:

- explain the bias.
- provide examples.
- include a call to action: how to prevent the bias.

Once you have shared your video, as a whole class, discuss the following questions.

### Reflection questions

1. How can being aware of biases help us to make better decisions?
2. What strategies can we use in our own lives to reduce the impact of biases?
3. To what extent are all of our decisions caused by biases? What other factors may influence our decisions?
4. Is bias inevitable in the production of knowledge?

### Learning outcomes

By the end of this section, you should be able to:

- Describe the role of the dual processing theory in understanding decision-making.
- Discuss the application of social learning theory to explain and change behaviour.
- Describe the role of anchoring bias in decision-making.
- Describe the role of confirmation bias in decision-making.
- Discuss the extent to which one could claim that all cognition is caused by the environment.
- Describe the value of the dual processing theory for understanding thinking and decision-making.





## 3 section questions ^

### Question 1

SL HL Difficulty:

While conducting her research for a school project on mental health, Zara focuses on articles and studies that highlight the harmful effects of social media, such as increased anxiety and depression. She dismisses articles that discuss potential benefits, such as improved social connections and access to support networks. What type of bias is demonstrated in this situation?

Confirmation



### Accepted answers

Confirmation

### Also accepted

Confirmation bias

### Explanation

Confirmation bias occurs when individuals favour information that supports their preconceptions and ignore or dismiss information that contradicts those beliefs. In this case, Zara is dismissing studies that suggest positive effects of social media, which reflects her bias toward confirming her negative view of social media's impact.

### Question 2

SL HL Difficulty:

System 1 uses mental shortcuts, known as 1 heuristics ✓ to simplify decision-making. These shortcuts can lead to systematic errors in judgement, known as 2 biases ✓ .

### Accepted answers and explanation

#1 heuristics

#2 biases

### General explanation

Biases are closely related to System 1 thinking, as described in the dual process model of thinking. System 1 is fast, automatic and intuitive, and often operates without conscious effort. It makes use of heuristics.

### Question 3

SL HL Difficulty:

During a charity auction, the host starts the bidding for a painting at \$500, even though the painting's actual value is closer to \$100. Many bidders end up offering amounts close to \$500. According to anchoring bias, how did the initial bid set by the host influence the bidders' decisions?

1 The bidders used the starting bid as a reference point for their offers. ✓

2 The initial bid discouraged bidders from participating.



3 The bidders ignored the original bid and focused on the painting's actual value.

4 The initial bid made the painting seem less valuable.



### Explanation

In this case, the starting bid of \$500 becomes the anchor that influences the bidders' perceptions of the painting's value. Even though the actual value of the painting is closer to \$100, the initial bid shifts their judgement upward, leading them to place higher bids that are anchored around \$500.



Overview

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5. Learning and cognition / 5.1 Thinking and learning



(https://intercom.help/kognity)



# What role does conditioning play in behaviour?

A-5: Perspective    B-4-1-3b: Describe examples of operant conditioning as a way of learning and illustrate how operant conditioning is applied in real-world scenarios.

B-4-1-4: Describe the role of the dual processing model for understanding thinking and decision-making.

B-4-2-4: Discuss the potential influence of one or more environmental factors on one cognitive process.

C-2-1: Describe the process of classical conditioning and its role in behaviour.    C-2-2: Describe the process of operant conditioning and its role in behaviour.

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## Teacher instructions

## Learning outcomes

- Describe the process of classical conditioning and its role in behaviour.
- Describe the process of operant conditioning and its role in behaviour.
- Describe examples of operant conditioning as a way of learning and illustrate how operant conditioning is applied in real-world scenarios.
- Describe the role of the dual processing model in understanding thinking and decision-making.
- Discuss the potential influence of one or more environmental factors on one cognitive process.
- Discuss the strengths and limitations of understanding human behaviour through a behaviourist perspective.

## Facilitation guidance

This section introduces students to two fundamental behaviourism theories: classical conditioning (learning through association) and operant conditioning (learning through consequences). Students will learn how these forms of conditioning shape behaviour and recognise real-life examples of each. Be sure to differentiate between the two theories by providing clear examples. Encourage students to think about the ethical implications of applications of these theories in real life, especially with punishment.

## Guiding question(s)

In this subtopic, you are thinking about the question, '**To what extent does my environment dictate my cognition and behaviour?**'. This section will help you make an informed response by working through the following guiding question:

- How does research into conditioning support the claim that 'humans lack behavioural control'?

Throughout your psychology journey, you have been examining different biological and environmental correlates of behaviour. This section invites you to explore the question, 'How does research into conditioning support the claim that humans have reduced behavioural control?' This section will take a behaviourist approach and examine both operant and classical conditioning.

The guiding questions in each section help to guide you towards answering the subtopic question(s) at the end of the subtopic. The subtopic questions require you to pull together your knowledge and skills from different sections, to see the bigger picture and to build your conceptual understanding.

Why do so many apps give you rewards, like badges or streaks?

Student  
view

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These rewards can be explained by behaviourism, a psychological perspective founded by John Watson, and further developed by B.F. Skinner. This perspective suggests that human behaviour is largely shaped and controlled by our environment, rather than internal processes or our free will.

Behaviourism suggests that we respond to stimuli based on our past experiences, especially because of reinforcement and punishment (**Figure 1**). This can cause automatic, conditioned responses that we have little conscious control over. The reliance on conditioning means that our behaviours are influenced by prior experiences (in other words, our environment) rather than autonomous decision-making. Behaviourism does not suggest we lack total control of our behaviours, it just suggests that the role of personal agency is minimised.



**Figure 1.** Behaviourism principles are applied to teach behaviours. One common application of this is training dogs, where using rewards (treats) helps reinforce behaviours such as sitting.

Credit: Gary Yeowell, Getty Images

## Operant conditioning

Operant conditioning, developed by psychologist B.F. Skinner, is a learning process that changes behaviour through the use of reinforcers and punishments. When a caregiver praises their child for performing a desired behaviour, such as helping wash the dishes, they are using positive reinforcement to encourage their child to continue the behaviour. Behaviours that are followed by positive reinforcers are more likely to be repeated, whereas those followed by negative punishment are less likely to be repeated. So, if a child misbehaves, a caregiver may take away their favourite video game so that they are less likely to misbehave in future.

There are four main elements in operant conditioning (**Figure 2**), which can be categorised into reinforcement (strengthening behaviour) and punishment (weakening behaviour).

### Reinforcement

- **Positive reinforcement** – when a reward is introduced to a stimulus to increase a behaviour. The Premack principle suggests that a preferred behaviour can be used as a reinforcer for a less preferred behaviour. For example, a caregiver might tell a child that they can play outside for an hour (more preferred) after they clean their room (less preferred).
- **Negative reinforcement** – when a negative stimulus is removed to increase a behaviour. For example, when a loud alarm gets turned off in the morning, a teenager is more likely to get out of bed on time.

Student view



## Punishment

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- **Positive punishment** – when a negative stimulus is introduced to decrease a behaviour. For example, when a child misbehaves in class, they may get sent to the headteacher's office.
- **Negative punishment** – when a desirable stimulus is removed to decrease a behaviour. For example, if a child misbehaves, their caregivers may take away their favourite video game.

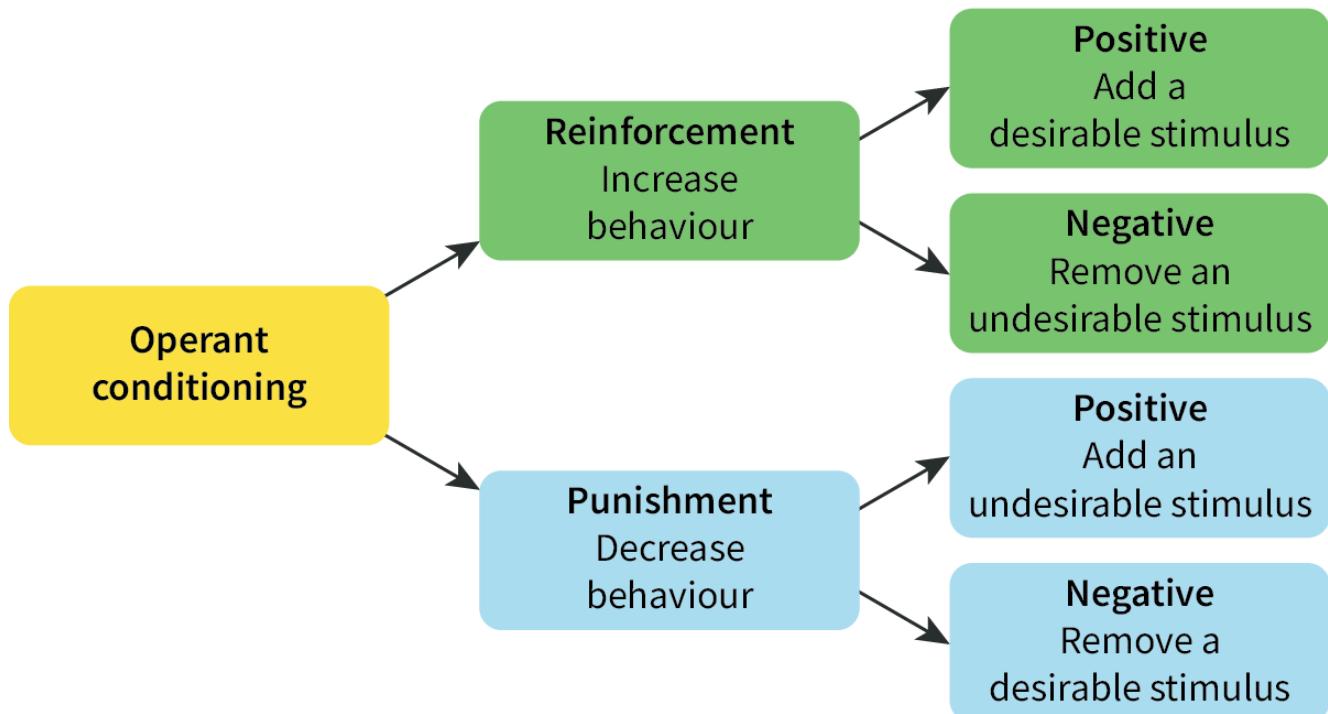


Figure 2. Operant conditioning.

More information for figure 2

Tree diagram showing that operant conditioning can involve reinforcement and punishment, and both of these can be positive or negative. Reinforcement increases a behaviour. Positive reinforcement involves adding a desirable stimulus. Negative reinforcement involves removing an undesirable stimulus. Punishment decreases a behaviour. Positive punishment involves adding an undesirable stimulus. Negative punishment involves removing a desirable stimulus.

Shaping is the process by which parts of a desired behaviour are continuously reinforced until the complete behaviour is achieved. For example, this may be used when learning a new skill, such as a small child learning how to tie their shoelaces. First, the caregiver may praise them just for holding the laces correctly. Next, the caregiver may praise them just for tying one loop correctly. Then, the caregiver praises them only when they are closer to tying the full shoelaces correctly, gradually guiding them towards the final skill.

### Creativity, activity, service

#### Strand

Service

#### Learning outcome

- Demonstrate that challenges have been undertaken, developing new skills in the process.



Apply the principles of operant conditioning to implement a change in your school or community. For example, a rewards system for recycling, or a 'step count' competition.

However, while behaviours can be learned, behaviours can also decrease over time when reinforcement is removed. For example, if a child stops receiving pocket money after doing chores at home, they may eventually stop doing their chores.

### Perspective lens

## Sociocultural approach

A sociocultural approach can help extend our understanding of behaviourism by emphasising how social and cultural factors influence the ways behaviours are learned and reinforced.

For example, Bandura's social learning theory (see [section 2.3.5 \(/study/app/psychology-new/sid-540-cid-763690/book/how-can-behaviourism-explain-addiction-id-49455/\)](#)) suggests that people learn behaviours through observation and imitation of others in their environment, such as their caregivers. Vicarious reinforcement suggests that we can learn from others' experiences, rather than experiencing the reward or punishment ourselves.

Additionally, what is reinforced or punished may depend on cultural values and norms. This suggests that when applying behaviourism, cultural contexts should be taken into consideration.

## Reflection questions

1. How have your own behaviours been shaped by cultural norms and social influences rather than just direct reinforcement or punishment?
2. How do cultural differences affect how people respond to rewards and punishments? Provide an example.

Operant conditioning has been used to modify behaviours in many different areas. For example, in the classroom (for example, using praise to reinforce good behaviour), workplace (for example, giving promotions to reinforce good work ethic) and in therapy (for example, using tokens to reinforce positive behaviours). Individuals can use the principles of operant conditioning to develop and maintain habits. Operant conditioning is considered active learning, as learners actively change their behaviours based on either rewards or punishment.

### Making connections

In [subtopic 2.3 \(/study/app/psychology-new/sid-540-cid-763690/book/the-big-picture-id-49450/\)](#), you learned about the role of operant conditioning in treating health problems.

Contingency management is a common strategy through which individuals are rewarded for good behaviours, such as alcohol abstinence. Mobile phone apps that allow participants to log behaviours and receive instant rewards are also common.

[Dallery et al. \(2017\)](#) applied the principles of reinforcement to shape and encourage people to stop smoking through an internet-based contingency management (CM) program. They aimed to evaluate the effectiveness and acceptability of the internet-based CM program. Smokers from across 26 states of the USA were randomised into two different conditions:

- An intervention group that received internet-based CM. These individuals received financial incentives (up to \$480 over 7 weeks) for verified smoking abstinence by submitting video-recorded breath carbon monoxide (CO) samples. Their CO levels needed to meet a certain threshold to be considered abstinent.
- The control condition received financial incentives based on submitting video-recorded CO samples, rather than based on abstinence.

- After four weeks, the abstinence rates significantly differed. The intervention group abstinence rate was 39.6%, whereas the control group was only 13%. However, in the long-term at the 3- and 6-month follow-up, while there was still a difference between the groups, this was not significant.
- 540-cid-763690/k This study demonstrates that CM programs via technology are feasible and effective in the short-term. Hence, these reward-based approaches should be considered as a way of addressing public health problems such as smoking.

However, one limitation of operant conditioning is that it overemphasises the role of external rewards, and hence there is less focus on the intrinsic motivation of the individual. This oversimplifies the complexity of learning, especially sustaining behaviours in the long-term, as once the rewards and punishments stop, the behaviour diminishes or stops. Many behaviours, such as personal hobbies and creative activities, can be driven by intrinsic motivation, rather than rewards and punishments. Operant conditioning also neglects cognitive factors such as beliefs and expectations (<https://doi.org/10.1146/annurev.psych.54.101601.145124>). These factors influence both learning and intrinsic motivation and may play a more significant role than rewards and punishments.

## Classical conditioning

Another learning process within the behaviourist perspective is classical conditioning. In contrast to operant conditioning, this process suggests that we develop involuntary responses to stimuli through conditioning. Ivan Pavlov, a prominent psychologist, first discovered this through his famous ‘Pavlov’s dogs’ experiment in the early 1900s.

In classical conditioning, individuals develop associations between a neutral stimulus and a stimulus that triggers a response naturally. The key elements of classical conditioning are:

- unconditioned stimulus, which naturally triggers a reflexive response.
- unconditioned response, which is a natural response to the unconditioned stimulus.
- neutral stimulus, which initially has no effect on the response.
- conditioned stimulus, which was once a neutral stimulus but, after being paired with the unconditioned stimulus, triggers a response.

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Assign

Before conditioning:

- An unconditioned stimulus (US) elicits an unconditioned response (UR).
- A neutral stimulus (NS) gives no response.

During conditioning:

- The NS is paired with the US.

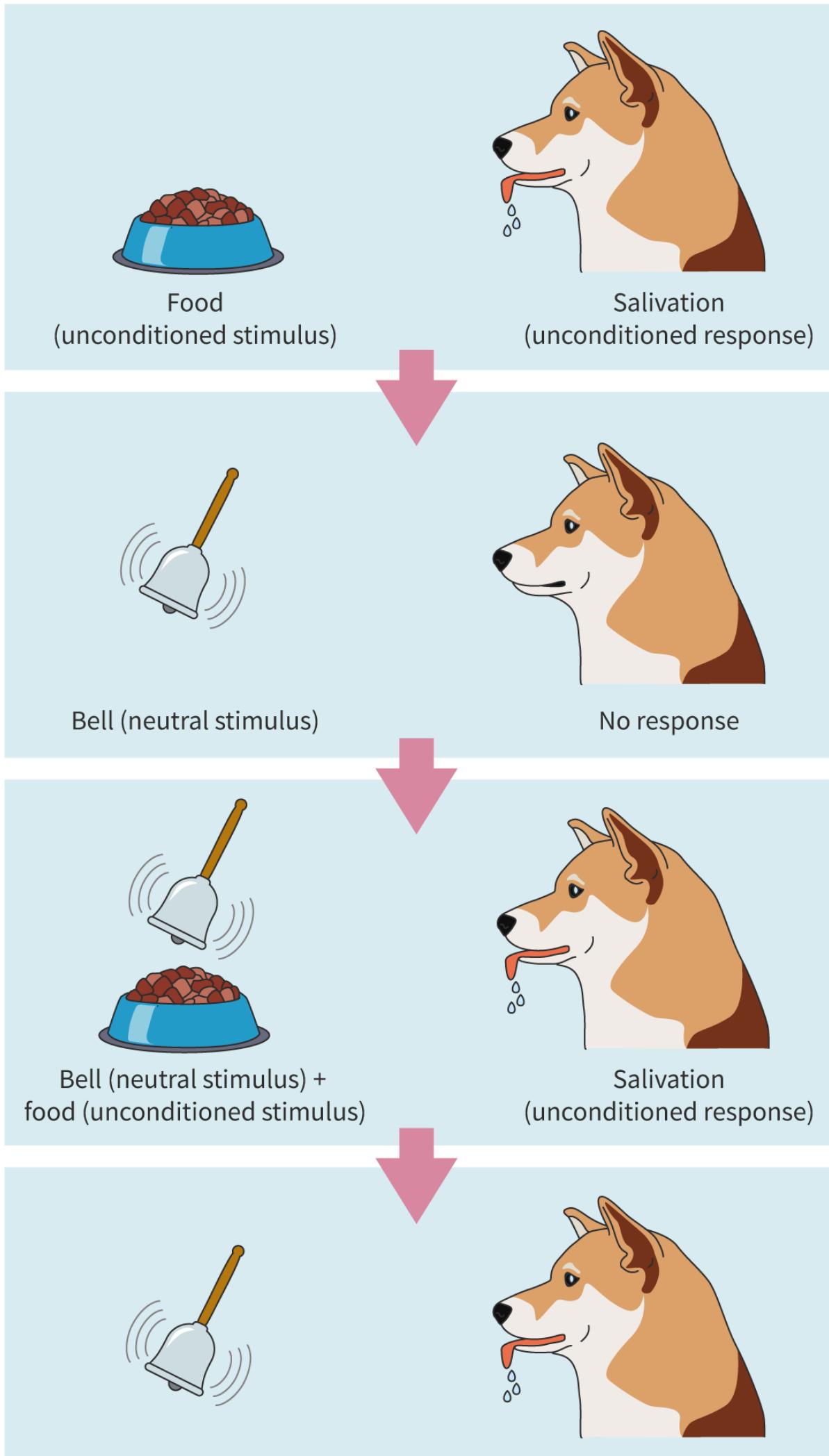
After conditioning

- The previous NS becomes the conditioned stimulus (CS) as it elicits the same response – the conditioned response (CR) – without the presence of the US.

For example, in Pavlov’s experiment, food (US) was presented to the dogs. This elicited the response of salivation (UR). Pavlov then paired the food with a bell (NS) repeatedly. Eventually, the bell became a CS, as the dogs began to salivate (CR) when hearing the bell (**Figure 3**).



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view



## Bell (conditioned stimulus)

## Salivation (conditioned response)

**Figure 3.** The process of classical conditioning.

More information for figure 3

Four pictures showing a dog's responses to stimuli. First, the dog exhibits an unconditioned response of salivation in response to an unconditioned stimulus of food. Second, the dog displays no response to a neutral stimulus of a bell. Third, the dog encounters both the neutral stimulus of the bell and the unconditioned stimulus of food, which results in the unconditioned response of salivation. Fourth, the dog is exposed to the bell, which is now a conditioned stimulus. The dog's salivation is a conditioned response.

The process of learning the association between the NS and the US is known as acquisition. The shorter the time between the NS and the US, the faster learning will occur. For example, ringing the bell immediately after the presentation of food will increase the speed of the dogs' salivation at the sound of the bell. However, if the CS is repeatedly presented without the US, the CR weakens and will eventually stop. This is known as extinction. So, when Pavlov stopped presenting food with the bell, the dogs eventually stopped salivating at the sound of the bell. After a period of time, this response can reappear when the CS is presented again on its own. This is known as spontaneous recovery.

The CR may also occur in response to stimuli that are similar to the CS. This is called generalisation. For example, the dogs may salivate at the sound of a chime which has a similar sound to the bell.

Just like operant conditioning, classical conditioning has many applications.

- Systematic desensitisation, a therapy technique used to eliminate anxiety or phobias, uses the principles of classical conditioning by gradually exposing individuals to their fear while teaching them to remain relaxed.
- Aversion therapy uses the principles of classical conditioning to discourage harmful behaviours, such as smoking and drinking, and to help people overcome addiction.
- It might not be obvious, but advertising also uses the principles of classical conditioning to create positive associations with products through adverts. A pleasant stimulus (US), such as a celebrity, is paired with a product (NS), eventually making the product a CS that triggers a positive emotional response (CR) towards the product.

Behaviours are learned through classical conditioning. For example, in some cultures, individuals make eye contact and smile at passing strangers, while in other cultures, they do not. The automatic response of offering a smile can be examined through a classical conditioning lens within the context of learning and cognition:

- Unconditioned stimulus: You receive a smile from strangers when they pass you on the street.
- Unconditioned response: Getting a smile feels good emotionally, and so, you smile back.
- Conditioned stimulus: A stranger passing by on the street is a neutral stimulus, but because of the cultural practice of giving and receiving smiles (and also warm emotional feelings), the stranger stimulus now serves to elicit a smile in you.
- Conditioned response: You now smile at strangers who pass you on the street.

### HL Extension

#### Motivation

### The role of motivation in conditioning



In operant conditioning, motivation dictates the strength and frequency of a behaviour based on the desirability of outcomes and the perceived consequences. In classical conditioning, motivation plays a more indirect role. For example, a student is offered \$5 by a family member for every A-grade they receive in their end-of-year exams (positive reinforcement). If the student is highly motivated by money, they will study harder to earn the reward. If the student is not motivated by money, then this may have less effect on their behaviour.

In contrast, the overjustification effect is when external reinforcers actually decrease a person's intrinsic motivation to perform a task. For example, students who once loved learning something new now do their schoolwork for the benefit of the reward.

Hanus and Fox (2015) (<https://doi.org/10.1016/j.compedu.2014.08.019>) examined whether adding game-like elements (such as leaderboards and badges) to a university course would help students stay motivated, put in more effort and perform better in their studies.

The researchers compared two groups of students:

- A control group, which had a normal course without game elements.
- An experimental group, which had a course with leaderboards and badges to encourage competition.

Over 16 weeks, the researchers checked how the students felt about their learning experience. They measured factors such as motivation, social comparison, satisfaction, effort and academic performance at four intervals during the semester.

They found that students in the gamified course became less motivated and less satisfied over time. Some students felt discouraged when they saw others doing better on the leaderboard.

In the end, students in the non-gamified course had higher motivation and better exam scores than those in the gamified course. Adding game elements such as leaderboards does not always help students learn better, and it can sometimes reduce motivation and performance.

## Application

Think about your IB DP studies.

- How do your teachers use game-like techniques (for example, interactive quizzes) in the classroom?
- Do these techniques motivate you to study more? Why? Why not?
- Consider the relationship between motivation and operant conditioning. How can schools, or the IB, leverage motivation and operant conditioning to develop certain skills and mindsets?

Design your own game-like learning system that utilises principles of operant conditioning for either Psychology or one you would like to study.

Share your system with the class. Once all class members have shared their systems, discuss the following questions.

## Reflection questions

1. How can you find the right balance between competition and motivation in your game-like learning system?
2. Will your system work for all students, or should it be adjusted based on individual preference?

Whilst classical conditioning is useful for understanding learning by association, it has several limitations.

- Similar to operant conditioning, classical conditioning only focuses on observable behaviours and does not account for internal, cognitive factors, such as decision-making, which can influence learning.
- Classical conditioning oversimplifies the complex process of learning, as it only explains very simple stimulus and response associations.
- Additionally, it does not explain why some individuals exhibit certain responses, while others do not. Individuals may be genetically predisposed to certain behaviours or be more influenced by their past experiences.



- Similar to operant conditioning, classical conditioning was developed based on experiments conducted on animals, which puts the generalisability to humans into question. However, behaviourism is based on observable behaviours, meaning that the process is quite objective, given we can see it happening.

## Concept

### Perspective

In this section, you have learned about classical and operant conditioning, both of which provide valuable insights into human behaviour. However, they only offer one perspective of human behaviour.

### Reflection question

- Discuss the strengths and limitations of understanding human behaviour through a behaviourist perspective.

## Teacher instructions

### Goals

- Describe the process of operant conditioning and its role in behaviour.
- Discuss the strengths and limitations of understanding human behaviour through a behaviourist perspective.

### Facilitation guidance

The activity is an application of operant conditioning. You can do this in small groups or as a class, deciding on a behaviour to reinforce and a method of reinforcement. However, if students choose the behaviour and the method of reinforcement, make sure that it is ethical and fun (such as clapping or standing on one leg).

## Activity

IB learner profile attribute: Open-minded/Reflective/Risk-taker/Knowledgeable

Approaches to learning: Thinking/Social skills

Time required to complete activity: 40 minutes

Activity type: Group

### Train a peer

You will ‘train’ a peer in this activity by applying the principles of operant conditioning.

### Procedure

- Decide on two students to exit the classroom. They are the ‘peers.’
- The remaining students should then choose a target behaviour (for example, clapping or standing on one leg) to ‘train,’ using operant conditioning.
- Ask the two peers to come back into the room. You will train them to perform the chosen behaviour without stating what it is. Use the following methods of reinforcement as they get closer to or further away from the target behaviour — you will need to decide on the ‘reward’ and ‘punishment’ as a group:
  - Positive reinforcement: give your peer a small reward (such as verbal praise) each time they perform a behaviour that is close to the target behaviour.
  - Positive punishment: you could jeer the peer by shouting ‘boo!’ when they veer away from the desired behaviour.



- c. Negative punishment: you could turn around and ignore the peer.
- d. Negative reinforcement: stop a mildly annoying sound or action when the peer performs the target behaviour (such as stopping a rhythmic clap or snapping fingers).

By implementing these types of reinforcement, your peers should learn the behaviour.

## Reflection questions

As a class, discuss the following:

1. Which type of reinforcement was most effective? Why?
2. How could a reinforcement schedule change the continuance of the behaviour?
3. How can you apply this to real-world scenarios?
4. (Concept application: perspective) What are the limitations of using a behaviourist perspective to understand human behaviour?

### Learning outcomes

By the end of this section, you should be able to:

- Describe the process of classical conditioning and its role in behaviour.
- Describe the process of operant conditioning and its role in behaviour.
- Describe examples of operant conditioning as a way of learning and illustrate how operant conditioning is applied in real-world scenarios.
- Describe the role of the dual processing model in understanding thinking and decision-making.
- Discuss the potential influence of one or more environmental factors on one cognitive process.
- Discuss the strengths and limitations of understanding human behaviour through a behaviourist perspective.

## 4 section questions ^

### Question 1

SL HL Difficulty:

A student receives praise for answering questions in class. As a result, they participate more frequently. This is an example of which type of conditioning?

Operant



### Accepted answers

Operant

### Also accepted

Operant conditioning

### Explanation

A teacher praising a student is a type of positive reinforcement, which will encourage a student to participate more often.

### Question 2

SL HL Difficulty:

Classical conditioning can explain how a person develops a fear of dogs after being bitten by one. The bite is the 1 unconditioned stimulus, and the dog becomes the 2 conditioned stimulus, triggering fear as the conditioned response.



**Accepted answers and explanation**

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#1 unconditioned

#2 conditioned

**General explanation**

Classical conditioning explains this fear as the person has developed an association. The bite is the unconditioned stimulus (US), and the dog becomes the conditioned stimulus (CS), triggering fear as the conditioned response (CR).

**Question 3**

SL HL Difficulty:

How could operant conditioning be used to encourage students to complete their homework regularly?

- 1 Provide extra credit points for completed homework or deduct points for incomplete homework. ✓
- 2 Pair the sound of a bell with the act of doing homework until the bell alone encourages completion.
- 3 Use the principle of generalisation to apply homework rules across all subjects.
- 4 Gradually reduce reinforcement to test whether the behaviour becomes extinct.

**Explanation**

The extra credit points are positive reinforcement for completed homework, whereas deducting points for incomplete homework is negative punishment.

**Question 4**

SL HL Difficulty:

Which of the following is a criticism of behaviourism as a psychological approach?

- 1 It neglects the role of biology and innate factors in shaping behaviour. ✓
- 2 It overemphasises cognitive processes and ignores observable behaviour.
- 3 It lacks practical applications in real-world settings, such as education or therapy.
- 4 It only focuses on complex, voluntary behaviours, ignoring simple reflexes.

**Explanation**

Behaviourism primarily focuses on observable behaviours and the effects of environmental stimuli, reinforcements and punishments.

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5. Learning and cognition / 5.1 Thinking and learning



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# Activity sheet: How can we understand thinking and learning?

## Section

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## Teacher instructions

## Learning outcomes

- Describe the role of the dual processing model in understanding decision-making.
- Explain the role of one or more cognitive biases in decision-making.
- To what extent could one claim that all cognition is caused by the environment?
- Describe the process of classical conditioning and its role in behaviour.
- Describe the process of operant conditioning and its role in behaviour.
- Discuss the potential influence of environmental factors on cognitive processes.

## Facilitation guidance

This activity sheet is designed to consolidate the learnings from this subtopic through application, analysis and evaluation of the key concepts learned. The tasks can be completed either individually or in small groups, where suitable.

In this activity, you will be checking your understanding of the dual process model, cognitive biases and behaviourism. You will have a chance to apply your knowledge, as well as evaluate the various models and theories covered.

## ? Subtopic question(s)

During this activity sheet, you will be working towards answering the following subtopic question:

- To what extent does my environment dictate my cognition and behaviour?

## Before you start

Make sure you review the dual process model, biases in thinking and decision-making, and behaviourism – all from this subtopic! It is also important to review your understanding of social learning theory, as well as schema theory, because both play a large role in learning and cognition, too.

## Part A

### Knowledge and understanding

The following questions are designed to test your knowledge of cross-cultural research in psychology.

Liam is researching whether a vegetarian diet is healthier than a diet with meat. He strongly believes that vegetarian diets are better for overall health. While researching online, he mainly clicks on articles and studies that support his belief and ignores those that suggest meat-inclusive diets can also be healthy. What cognitive bias best explains Liam's behaviour?



Confirmation



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**Accepted answers**

Confirmation

**Also accepted**

Confirmation bias

Which of these is a limitation of using experiments to study the dual process model of thinking?

- 1 The tasks often lack ecological validity, as they may not fully replicate the complex decision-making processes that people face in daily life. ✓
- 2 The tasks are often unable to distinguish between System 1 and System 2 thinking in any meaningful way.
- 3 The tasks often make it impossible to measure automatic, unconscious responses due to the reliance on self-reported data.
- 4 The tasks often rely on operant conditioning methods, which do not apply to decision-making processes.

Which of the following is considered a strength of operant conditioning in explaining behaviour?

- 1 It explains how behaviours can be shaped over time by reinforcing desired actions, making it useful for behaviour modification. ✓
- 2 It addresses both conscious and unconscious thoughts, providing a complete understanding of decision-making processes.
- 3 It suggests that all behaviours are biologically predetermined, eliminating the influence of learning.
- 4 It emphasises the role of associations without needing consequences, which are effective for automatic responses.

After repeatedly seeing a logo with a jingle on TV, a viewer starts humming the tune without thinking when they see the logo. Which theory best explains this learned association?

- 1 Classical conditioning ✓
- 2 Operant conditioning
- 3 System 1 thinking
- 4 System 2 thinking

## Part B

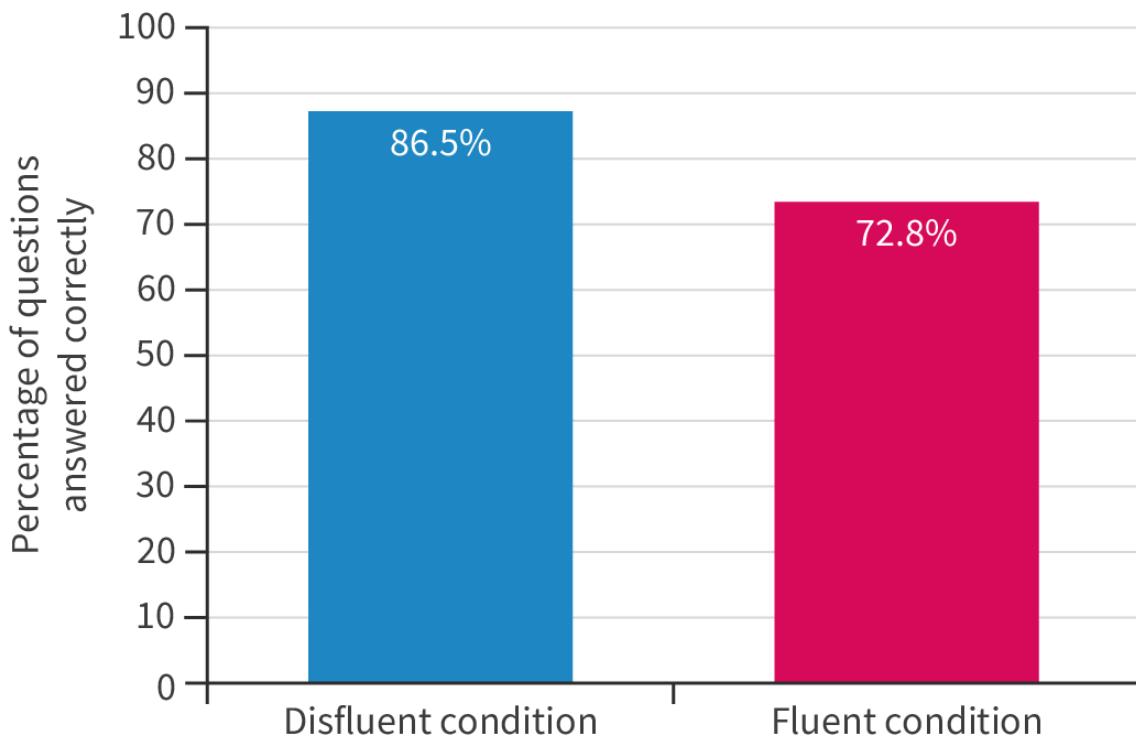
### Application and analysis

Diemand-Yauman, Oppenheimer and Vaughan (2011)  (<https://doi.org/10.1016/j.cognition.2010.09.012>) investigated the extent to which disfluent fonts can lead to deeper processing. Participants learned about three fictional alien species, each with seven unique features, totalling 21 features to memorise. Participants were assigned to either a 'disfluent' condition, where material was in 12-point 60% grayscale Comic Sans font (harder to read), or a 'fluent' condition, with clearer, 16-point black Arial font. They had 90 seconds to study the information, followed by a 15-minute distraction task. Finally, their memory was tested on seven randomly chosen features, with questions like, 'What is the diet of the pangerish?'<sup>1</sup>

The results of the study are summarised in **Figure 1**.



Student  
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**Figure 1.** The results of the disfluency study.

Source: Diemand-Yauman, C., Oppenheimer, D.M. & Vaughan, E.B. (2011) ↗

(<https://www.sciencedirect.com/science/article/abs/pii/S001002771000226X?via%3Dihub>). 'Fortune favors the bold (and the italicized): Effects of disfluency on educational outcomes', *Cognition*, Volume 118, Issue 1, 2011, Pages 111–115. Copyright © Elsevier B.V.

How do the results of this disfluency study demonstrate System 1 and System 2 thinking? Use **Figure 1** to support your explanation.



#### Key

As shown in the graph (**Figure 1**), the fluent-font condition answered fewer questions accurately (72.8%) compared to the disfluent-font condition (86.5%). This indicates that the participants who read the descriptions in the disfluent font engaged their System 2 thinking, because they had to slow down to read and remember the descriptions, using logical reasoning.

Why was it important that the researchers used fictional alien species?



**Key**

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The use of fictional alien species allowed the researchers to increase the internal validity of the study. It was important that they used fictional alien species so that no participant would be more or less familiar with the topic than another. If the researchers had used a topic that was not fictional, some participants may have been familiar with the topic. Hence, the difference in the results could have been due to the familiarity with the topic, rather than the font used.

The study used a self-selected sample of 28 Princeton University students, who were reimbursed \$12 for participating. Explain **one** limitation of this sample.

**Key**

Participants who self-select may be highly motivated, particularly if there is an incentive for participation. This introduces sampling bias, as these participants could be putting in extra effort in comparison to a sample obtained through opportunity sampling or random sampling.

A second limitation exists as a result of the population from which the self-selected sample was taken. As you may know, it is exceptionally difficult to receive admission to Princeton University, and therefore this population is not representative of Americans as a whole.

In the study of cognitive psychology, experiments are used to test the relationship between two variables. Experiments can establish **causality**, as they often have rigorous control over extraneous and confounding variables (high internal validity). However, sometimes this comes at the cost of low external validity.

Is it possible to establish causality in Diemand-Yauman, Oppenheimer and Vaughan's (2011) ↗ (<https://doi.org/10.1016/j.cognition.2010.09.012>) study? Why? Why not?

**Key**

Because the study was a lab experiment and had tight control over confounding variables, as well as random assignment to conditions, causality can be established.

What implications do these findings have for your own studying and learning?





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### Key

This study demonstrates that writing content in different fonts can engage System 2 thinking. This means that when studying, you could write down important points or concepts in different colours or fonts to make them different from less important points or concepts. Teachers could also use these findings to draw attention to important concepts by using different fonts.

## Part C

### Synthesis and evaluation

Create a poster that summarises and contrasts the three main theories covered in this subtopic:

- Dual process model
- Operant conditioning
- Classical conditioning.

Your poster should include the following points of contrast:

- Theory name
- Key concepts
- Primary focus
- Mechanisms of learning/behaviour change
- A key research study
- Examples in daily life
- Strengths
- Limitations.



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Once you have completed your poster, share it with the group. Then discuss the following questions:

1. Which model do you think best explains human decision-making and behaviour, and why?
2. Can these models work together to provide a fuller understanding of behaviour? Why? Why not?



Student  
view



## Summary

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As you have learned and explored in this activity, many factors in our environment influence our thinking and decision-making. This can be explained by the dual process model of thinking and decision-making, and two key behaviourism theories: operant conditioning and classical conditioning.

## Reflection

Referring back to the subtopic question:

- To what extent does my environment dictate my cognition and behaviour?

How would you answer this question after completing this activity?



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5. Learning and cognition / 5.1 Thinking and learning

# Checklist



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## Learning outcomes

By the end of **subtopic 5.1**, you should be able to:

- Describe the role of one or more cognitive models in understanding a cognitive process or behaviours.
- Describe the role of the dual processing model in understanding thinking and decision-making.
- Discuss how the dual processing model of thinking and decision-making can provide an explanation for cognitive biases.
- Describe the value of the dual processing model for understanding thinking and decision-making.
- Describe one or more strategies to improve one or more cognitive processes.
- Describe the role of anchoring bias in decision-making.
- Describe the role of confirmation bias in decision-making.
- Discuss the extent to which one could claim that all cognition is caused by the environment.
- Describe the process of classical conditioning and its role in behaviour.
- Describe the process of operant conditioning and its role in behaviour.
- Describe examples of operant conditioning as a way of learning and illustrate how operant conditioning is applied in real-world scenarios.
- Discuss the potential influence of one or more environmental factors on one cognitive process.
- Discuss the strengths and limitations of understanding human behaviour through a behaviourist perspective.

## HL Extension

- Discuss the extent to which learning and cognition across cultures is similar and different.

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# Collected research studies

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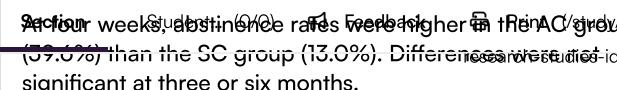
Glossary

Reading  
assistance

## Teacher instructions

These are the main research studies mentioned throughout this subtopic. However, this is not an exhaustive list, and you are encouraged to use other research studies that are relevant.

Students are not required to memorise all details of the studies but may wish to include them to support their explanations.

Summary	Evaluation
<p><b>Dallery et al. (2017)</b>  (<a href="https://doi.org/10.1111/add.13715">https://doi.org/10.1111/add.13715</a>)</p> <p><b>Location of study</b> USA</p> <p><b>Aim</b> To evaluate the effectiveness and acceptability of an internet-based contingency management (CM) programme</p> <p><b>Method</b> A randomised control trial recruited 94 smokers (mean age 36, 56% female) from 26 US states. Participants were randomised into two groups: abstinence contingent (AC), earning financial incentives for video-verified abstinence, or submission contingent (SC), earning incentives for submitting carbon monoxide (CO) samples. Both groups followed a CO-based goal-setting programme, and abstinence was assessed at four weeks, three months and six months.</p> <p><b>Results</b>  After four weeks, abstinence rates were higher in the AC group (37.5%) than the SC group (13.0%). Differences were not significant at three or six months.</p> <p><b>Conclusion</b> Internet-based CM using financial incentives significantly increased short-term smoking abstinence compared to goal-setting alone.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>High generalisability, as there were participants from across the US</li> <li>Randomised controlled trial strengthens the validity of the results by minimising selection bias and allowing for causal inferences</li> <li>The use of CO testing provided an objective measure of smoking abstinence, reducing reliance on self-reported data.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>The study primarily assessed short-term abstinence rates, with limited data on long-term smoking cessation outcomes.</li> <li>Participants who volunteered for the study may have been more motivated to quit smoking, limiting the generalisability.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>Participants were likely informed about the study's purpose and procedures, ensuring informed consent.</li> <li>While financial incentives can be effective, they may also lead to undue pressure on participants, especially those with financial difficulties.</li> </ul>

Summary	Evaluation
<p><b>Diemand-Yauman, Oppenheimer and Vaughan (2011)</b> ↗ (<a href="https://doi.org/10.1016/j.cognition.2010.09.012">https://doi.org/10.1016/j.cognition.2010.09.012</a>)</p> <p><b>Location of study</b> USA</p> <p><b>Aim</b> To investigate whether introducing disfluency — making educational materials slightly more difficult to read — can enhance learning and retention</p> <p><b>Method</b> Participants read passages about extra-terrestrials presented in either easy-to-read or hard-to-read fonts. They were then tested on their recall of the information.</p> <p><b>Results</b> Both studies found that participants exposed to disfluent (hard-to-read) fonts demonstrated better retention and recall of the material compared to those who read the same content in fluent (easy-to-read) fonts.</p> <p><b>Conclusion</b> Introducing disfluency into educational materials can serve as a 'desirable difficulty,' prompting deeper cognitive processing and thereby improving learning outcomes.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>The study introduces a novel method to enhance learning by manipulating the readability of text.</li> <li>The use of controlled laboratory settings and real-world classroom environments strengthens the validity of the findings.</li> <li>The results suggest simple, cost-effective strategies for educators to improve student learning.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>The study focuses primarily on font readability, which may not encompass all factors influencing learning.</li> <li>The studies primarily assess immediate recall, with limited data on long-term retention.</li> <li>The studies may not account for individual differences in reading abilities or preferences.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>The study likely maintained participant confidentiality, especially given the educational context.</li> <li>While disfluency can enhance learning, it may also increase cognitive load, potentially causing frustration for some learners.</li> </ul>
<p><b>Piksa et al. (2024)</b> ↗ (<a href="https://doi.org/10.3389/fpubh.2024.1414864">https://doi.org/10.3389/fpubh.2024.1414864</a>)</p> <p><b>Location of study</b> Europe</p> <p><b>Aim</b> To explore whether increasing awareness of confirmation bias can reduce individuals' susceptibility to misinformation</p> <p><b>Method</b> Participants were either informed about confirmation bias or not, and then presented with both biased and neutral information. Their responses to misinformation were analysed before and after exposure.</p> <p><b>Results</b> Those aware of confirmation bias were less likely to accept misinformation compared to those who were not.</p> <p><b>Conclusion</b> Awareness of confirmation bias can help individuals critically evaluate information, reducing the impact of misinformation.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>The study provides valuable insights into how awareness of confirmation bias can reduce susceptibility to misinformation.</li> <li>It uses a clear experimental design and directly assesses participants' responses to biased information.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>The study may have limitations in generalisability, as the sample size or context may not reflect broader populations or real-world settings.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>Participants were likely informed of the study's purpose, ensuring informed consent. However, careful attention would be needed to avoid any psychological harm from exposing participants to misinformation.</li> </ul>

Summary	Evaluation
<p><b>Summary</b></p> <p><b>Ly et al. (2023) ↗</b> <a href="https://doi.org/10.1001/jamainternmed.2023.2366">https://doi.org/10.1001/jamainternmed.2023.2366</a></p> <p><b>Location of study</b></p> <p>USA</p> <p><b>Aim</b></p> <p>To examine how physicians' initial diagnoses can influence their decision-making, potentially leading to delayed diagnosis of conditions like pulmonary embolism (PE) in patients with congestive heart failure (CHF)</p> <p><b>Method</b></p> <p>This cross-sectional study analysed data from 108,000 patients with CHF who presented to emergency departments with shortness of breath between 2011 and 2018. Researchers compared cases where the visit reason mentioned CHF to those with broader descriptions, assessing the likelihood of PE testing based on the initial documentation.</p> <p><b>Results</b></p> <p>Physicians were less likely to test for PE when the initial documentation mentioned CHF, indicating that the initial diagnosis influenced subsequent decision-making.</p> <p><b>Conclusion</b></p> <p>Anchoring bias, where initial information disproportionately influences decision-making, can lead to delayed diagnosis of critical conditions like PE in patients with CHF. Recognising and mitigating this bias is essential for improving diagnostic accuracy.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>The study's extensive dataset enhances the reliability and generalisability of the findings.</li> <li>By analysing actual clinical data, the study provides insights into everyday medical decision-making processes.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>As a cross-sectional study, it cannot establish causality between initial documentation and subsequent testing decisions.</li> <li>The study may not account for all variables influencing physicians' decisions, such as patient history or clinical presentation.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>Ensuring patient confidentiality and secure handling of medical records is crucial.</li> <li>While retrospective studies often use de-identified data, obtaining consent for the use of patient information is an ethical requirement.</li> </ul>

Summary	Evaluation
<p><b>Alter et al. (2007)</b> ↗ (<a href="https://doi.org/10.1037/0096-3445.136.4.569">https://doi.org/10.1037/0096-3445.136.4.569</a>)</p> <p><b>Location of study</b> USA</p> <p><b>Aim</b> To investigate whether certain environmental augmentations can induce System 2 thinking</p> <p><b>Method</b> Four different laboratory experiments were conducted:  Experiments (1) and (4) investigated the impact of hard-to-read font on accurate responses to logic problems. Experiment (3) investigated the impact of furrowing one's brow on accurate responses, and experiment (2) investigated reliance on peripheral clues.</p> <p><b>Results</b> All four experiments supported the conclusion that disfluency engages metacognition, which seems to activate System 2 levels of reasoning. This reasoning can assess and sometimes correct the output of System 1's initial response.</p> <p><b>Conclusion</b> We can activate System 2 through environmental 'speed bumps' of cognition, such as presenting information in a hard-to-read font or requiring additional metacognitive steps.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>The experiments added insight and additional perspectives regarding system thinking.</li> <li>Results triangulate the existence of dual processing (System 1 and System 2).</li> <li>The use of four different experiments with slightly different procedures serves to triangulate each one and increase validity.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>Laboratory experiment introduces artificiality and therefore may lack ecological validity. Although we encounter logic problems in real life, we are most often faced with 'problems' that are less concrete.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>All researchers conducting studies within psychological research are expected to consider ethical guidelines.</li> </ul>

Summary	Evaluation
<p><b>Keysar, Hayakawa and An (2012) ↗</b>  <a href="https://doi.org/10.1177/0956797611432178">https://doi.org/10.1177/0956797611432178</a></p> <p><b>Location of study</b>    USA</p> <p><b>Aim</b>    To investigate whether the framing effect can be reduced through the presentation of information in a foreign language</p> <p><b>Method</b>    In this repeated measures laboratory experiment, participants were presented with a series of slightly opaque economic proposals in either their main language (independent variable — IV) or a second language (IV).    The dependent variable (DV) was whether or not they selected the riskier option for economic gain or loss.</p> <p><b>Results</b>    The framing effect disappeared when choices were presented in a second language.    Participants were risk-averse for gains and risk-seeking for losses when choices were presented in their main language. This framing manipulation did not influence them in a second language.</p> <p><b>Conclusion</b>    The presentation of information in a second language requires the brain to slow down and, therefore, engage System 2. Doing so makes the mind less prone to System 1 bias.</p>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>The study added insight and additional perspectives regarding system thinking.</li> <li>Results triangulate the existence of dual processing (System 1 and System 2), as they demonstrate more ‘logical’ reasoning when information is presented in a second language.</li> <li>The study used a clever and novel way of getting the mind to slow down.</li> </ul> <p><b>Limitations</b></p> <ul style="list-style-type: none"> <li>Laboratory experiment introduces artificiality and, therefore, may lack ecological validity</li> <li>While people do frequently face economic questions, such as budget and investment choices, these are often presented to them in their first language. However, the study suggests that those individuals who are living and engaging in investment behaviour in their second language may find they make more rational economic choices in that language.</li> </ul> <p><b>Ethical considerations</b></p> <ul style="list-style-type: none"> <li>All researchers conducting studies within psychological research are expected to consider ethical guidelines.</li> </ul>

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