

an extraterrestrial civilization. However, this was debunked in 2001 when a high-resolution picture was taken of the same surface object, revealing that it was nothing more than a rock formation. People have a schema of a face because recognizing faces is an important aspect of survival. Pattern recognition as a part of top-down processing driven by this schema leads us to perceive faces readily even when the data is fuzzy. (If you are not convinced, search for "Charlie Chaplin illusion" on YouTube.)

See video

The Charlie Chaplin illusion: https://www.youtube.com/watch?v=QbKw0_v2clo



Michael Shermer, "Why people believe weird things": https://www.ted.com/talks/michael_shermer_on_believing_strange_things

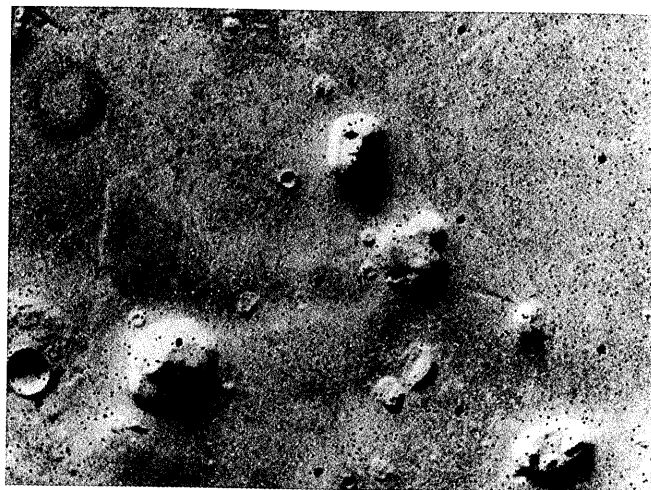


Psychology in real life

Gillian Gibbons, a UK national who worked as a teacher in a private school in Sudan, asked her 7-year-old students to decide on a name for a classroom teddy bear as part of a larger project on studying animals. The children voted for "Muhammad". As part of their assignment later they needed to take pictures of the teddy bear and write diary entries about it which the teacher collected in a single workbook entitled "My name is Muhammad". What seemed like a harmless class assignment turned out to be a cultural shock for Ms Gibbons. When some parents saw the workbook, they complained to the Ministry of Education claiming that Ms Gibbons had offended Islam by allowing an animal to be named after Prophet Muhammad. Insulting the Prophet is a grave offence in Sudan.

Ms Gibbons was arrested at her home on 25 November 2007. This 54-year-old teacher was facing a charge of up

Similarly, we seem to have a drive for finding meaning in these patterns. This might explain conspiracy theories that flourished around the "Face on Mars".



▲ Figure 3.14 "Face on Mars" photograph

to 1 year in jail, a fine and 40 lashes with a whip. The case gained wide coverage and there were demonstrations with people demanding a more severe punishment. She was finally found guilty and sentenced to 15 days in jail with subsequent deportation from Sudan. She was pardoned after nine days (which caused some protests in the public) and returned to England immediately after release.

This shows how a cultural misunderstanding, a difference in "cultural schemas", can have severe consequences. <https://tinyurl.com/lnx6a3x>



Thinking and decision-making

Inquiry questions

- Do people make rational decisions?
- Are human errors in thinking and decision-making predictable?
- Do intentions affect behaviour?
- How can we test a model of thinking empirically and in a quantifiable way?
- How can we research the process of thinking rather than its outcomes?

What you will learn in this section

- Normative models and descriptive models
 - Normative models describe the way that thinking should be; they assume unlimited time and resources, examples: formal logic, theory of probability, utility theory
 - Descriptive models describe thinking as it actually occurs in real life
- Macro-level decision-making models: the theory of reasoned action Fishbein, 1967) and the theory of planned behaviour (Ajzen, 1985)
 - Ajzen and Fishbein (1973): meta-analysis shows a 0.63 correlation between intention and behaviour
 - Albarracin *et al* (2001): meta-analysis of condom use; correlation between intention and behaviour 0.51; Intention-intention-behaviour relationship is weaker for behaviours assessed prospectively
 - Predictive validity of the models is high, but direction of causality is inferred because research is essentially correlational
- Micro-level decision-making model: the adaptive decision maker framework (Payne, Bettman and Johnson, 1993)
 - Multiattribute choice problems
 - Alternative-based strategies: weighted additive strategy (WADD), satisficing strategy (SAT)
 - Attribute-based strategies: lexicographic strategy (LEX), elimination by aspects (EBA)
 - Strategy selection is guided by four meta-goals: maximizing decision accuracy, minimizing the cognitive effort, minimizing the experience of negative emotion, maximizing the ease of justification of a decision
 - Supporting study: Luce, Bettman and Payne (1997), minimizing experience of negative emotions occurred through avoiding emotionally difficult trade-offs between options
- More research methods used in the cognitive approach to behaviour:
 - Self-report measures (behavioural and attitudinal)
 - ◆ Data matrix, correlation analysis
 - ◆ Predictive validity of a model
 - Meta-analysis
 - Computer simulation
 - Verbal protocols
 - Monitored information search
 - Neuroimaging techniques

This section also links to:

- concepts of the cognitive approach to behaviour (the role of models)
- principles of the cognitive approach—mental processes can be studied scientifically; cognitive processes do not function in isolation

- research methodology
- biases in thinking and decision-making
- emotion and cognition
- brain structure, localization of function (biological approach to behaviour).

Thinking and decision-making: normative models and descriptive models

In the computer metaphor different cognitive processes are responsible for processing information at different stages. For example, the function of perception (as a cognitive process) is to register information, while the function of memory is to encode, store and retrieve it. The function of **thinking** is to modify this information: we break down information into lesser parts (analysis), bring different pieces of information together (synthesis), relate certain pieces of information to certain categories (categorization), make conclusions and inferences, and so on. Unlike other cognitive processes, thinking produces new information. Using thinking, we combine and restructure existing knowledge to generate new knowledge. Thinking has been defined in many ways, including “going beyond the information given” (Bruner, 1957) and “searching through a problem-space” (Newell and Simon, 1972).

Decision-making is a cognitive process that involves selecting one of the possible beliefs or actions, that is, making a choice between some alternatives. It is closely linked to thinking because before we can choose, we have to analyse. So thinking is an integral prerequisite of any act of decision-making.

Thinking and decision-making are complex higher-order cognitive processes, which may be the reason why this field of research is so interdisciplinary. Thinking and decision-making are studied by psychologists, philosophers, economists, neuroscientists, computer scientists, linguists (because abstract thinking involves language) and anthropologists among others. Much like memory, thinking and decision-making are

implicit processes that cannot be directly observed. They also involve interaction between a large number of factors. For this reason, the scientific study of thinking and decision-making is not possible without **models**. So how do we approach making a model of thinking? It seems like an immense task.

As a starting point, it is necessary to distinguish between two broad groups of models (Baron, 2008).

ATL skills: Communication

Imagine a 12-year-old asks you why it is important to make a “model of thinking”. Explain it to him or her.

Normative models

Normative models describe the way that thinking should be. They assume that unlimited time and resources are available to make a decision. They define what is right and wrong, correct and incorrect, effective and ineffective.

One example of a normative model of thinking is **formal logic**, as developed by Aristotle. The building block of the system of formal logic is a deductive syllogism: a combination of two premises and a conclusion (which follows from these premises). There is a set of rules that describes when syllogisms are valid and when they are not. For example:

(Premise 1) All men are mortal.

(Premise 2) All Greeks are men.

(Conclusion) Hence, all Greeks are mortal.

This example is valid. Formal logic explains why. In fact, there is even a name for this type of syllogism: Barbara. “A” stands for a general affirmative statement (“All men are mortal” is affirmative

because it asserts something, and general because it refers to all men). Since all three statements in the syllogism are of the same type, it gives us triple A, hence the name (bArbArA).

Another example of a normative economic model is the **theory of probability**. When we make investment decisions, we might go with our intuition, but the “normative” thing to do is to analyse the success or failure frequencies in the past for similar enterprises under similar circumstances, and then make decisions based on the likely outcomes projected from this analysis.

Utility theory is the normative model for decisions involving uncertainty and trade-offs between alternatives. According to this theory, the rational decision-maker should calculate the expected utility (the degree to which it helps us achieve our goals) for each option and then choose the option that maximizes this utility.

The important thing to understand is that normative models give us a standard against which real-life thinking and decision-making may be compared. Why do we even need other models? Because normative models are unrealistic. Nobody actually thinks in syllogisms in real life. And nobody has access to a large amount of statistical data for every possible decision. We need to take shortcuts.

TOK

In what areas of knowledge have people been more successful in using the “ideal” normative models of thinking and decision-making? How did they manage?

Descriptive models

Descriptive models show what people actually do when they think and make decisions. They focus on an accurate description of real-life thinking patterns and the main measure of effectiveness for such models is how closely the model fits observed data from various samples of participants. Descriptive models will be the main focus of our discussion in this section, because this is what interests a psychologist. However, descriptive models acquire much deeper meaning when we compare them to normative models, as we study how human thinking processes deviate from the predictions of the normative model and try to explain (and predict) these deviations.

ATL skills: Thinking

You are about to discover some things about how people make decisions. Before you read on, can you make some predictions on the basis of your common knowledge and interpersonal experience? Answer these questions and give your reasons.

1. Are people mostly rational beings?
2. If there are errors in our judgments, are these errors predictable?
3. Can people control the rationality of their decisions?
4. What factors are most important when making a choice between several alternatives?
5. What are the goals that people generally pursue when they make decisions?

Multiple descriptive models have been proposed to describe the real-life processes of human thinking and decision-making. We will consider several examples: the theory of reasoned action, the theory of planned behaviour, and the adaptive decision-maker framework.

The theory of reasoned action and the theory of planned behaviour

The theory of reasoned action (TRA) aims to explain the relationship between attitudes and behaviours when making choices. This theory was proposed by **Martin Fishbein** in 1967. The main idea of the theory is that an individual’s choice of a particular behaviour is based on the expected outcomes of that behaviour. If we believe that a particular behaviour will lead to a particular (desired) outcome, this creates a predisposition known as the **behavioural intention**. The stronger the behavioural intention, the stronger the effort we put into implementing the plan and hence the higher the probability that this behaviour will actually be executed.

There are two factors that determine behavioural intention: **attitudes** and **subjective norms**. An attitude describes your individual perception of the behaviour (whether this behaviour is positive or negative) while the subjective norm describes the perceived social pressure regarding this behaviour (if it is socially acceptable or desirable to do it). Depending on the situation, attitudes and subjective norms might have varying degrees of importance in determining the intention.

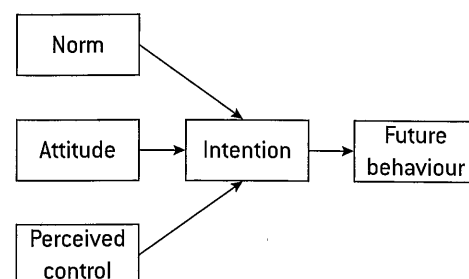
In 1985 the theory was extended and became what is known as the **theory of planned behaviour (TPB)**. This theory introduced the third factor that influences behavioural intentions: **perceived behavioural control**. This was added to account for situations in which the attitude is positive, and the subjective norms do not prevent you from performing the behaviour; however, you do not think you are able to carry out the action.

Research in focus: Methods of research for macro-level cognitive models

The majority of research studies in this area use self-report behavioural and attitudinal measures. The items on questionnaires and surveys are framed differently to refer to different components of the model. For example:

- Behaviour—"I always use available discount coupons when I make purchases online": True or false
- Intention—"I intend to use available discount coupons next time I buy something expensive": Likely or unlikely
- Attitude—"Spending time to collect coupons and plan their use is...": Good/bad; pleasant/unpleasant
- Perceived norms—"Most of my friends would not approve of me collecting discount coupons": Agree or disagree
- Perceived behavioural control—"I am sure I can save a considerable amount of money by collecting discount coupons": Agree or disagree

After this information is collected, you have a large **data matrix** in which each row corresponds to an individual participant and each column corresponds to a question on the survey (or a group of questions all related to a particular attitude or an aspect of behaviour). You also have a theoretical model, for example, for the theory of planned behaviour:



▲ Figure 3.15 The model for the theory of planned behaviour

The theory of reasoned action and the theory of planned behaviour have seen extensive applications in an attempt to explain a range of specific behaviours. We will consider several examples that demonstrate the nature of this research and the methods that are usually applied in it.

Using **correlation analysis** (and its more sophisticated extensions) you then estimate the extent to which this model fits the observed data (that is, the data matrix). For example, in order to conclude that the model is a good fit to the data, the following trends should be observed.

- There **should** be a large and significant correlation between: attitude and intention; perceived norms and intention; perceived control and intention; intention and future behaviour.
- There **should not** be a large correlation between norms and future behaviour; attitudes and future behaviour, and so on. If one of these correlations exists, you have to refute the model as it means that one of these components is linked to behaviour directly, which contradicts the very idea of the theory of planned behaviour.

Collectively, the four variables should be able to explain a significant portion of variance in the responses to the target variable (future behaviour). In other words, using the data it should be possible to build a mathematical formula that predicts future behaviour from the other four variables with a high degree of probability. This measure of probability is also referred to as **the predictive validity of the model**.

ATL skills: Self-management

Take a minute to recall what you know about correlation (see "Research methodology"). To test your knowledge, answer these questions.

- What is the "third variable"?
- What does it mean when someone says that a correlation is "statistically significant"?
- What is the range of values of the correlation coefficient?
- What does a negative correlation mean?
- What does a zero correlation mean?
- What is the difference between effect size and statistical significance?
- What does this mean: $r = 0.56, p < 0.05$?

Research studies have shown that the predictive validity of TPB for a range of specific activities is quite impressive. **Ajzen and Fishbein (1973)**, as a result of their own meta-analysis of published research, report a 0.63 correlation between intentions and behaviour.

ATL skills: Self-management

Is this correlation small or large? Review Unit 1 on research methodology.

Albarracin et al (2001) conducted a meta-analysis of TRA and TPB as models of condom use. The practical significance of the study lies in the fact that identification of important attitudinal or behavioural predictors of the frequency of condom use can help greatly in the prevention of HIV and STD epidemics. This is why it is important to understand why people choose to use or not to use condoms.

ATL skills: Research

Discuss the relative strengths and limitations of meta-analysis as a research method. How does meta-analysis relate to the problem of replicability in science?

The meta-analysis comprised 42 published and unpublished articles and a total of 96 data sets (which were brought together in one combined data matrix). Fitting the models of TRA and TPB into this

data set and estimating the predictive validity of the models, they arrived at the following conclusions.

- Both the TRA and TPB are successful predictors of condom use. The average correlation between intention and behaviour in these models is 0.51. Notice that it is a weaker intention-behaviour association than that reported by Ajzen and Fishbein (1973). One possible explanation is that people generally have less control over condom use than other behaviours in some other domains.
- It makes a difference whether behaviour is assessed **retrospectively or prospectively**. In the former case, assessments of intentions and behaviour are carried out at the same time. In the latter case, intentions and behaviour are assessed at different time periods. Naturally, the intention-behaviour relationship is weaker for behaviours assessed prospectively (0.45) than for behaviours assessed retrospectively (0.57). However, even 0.45 is sufficient enough to say that the predictive validity of the model is high.
- "Thus, people are more likely to use condoms if they have previously formed the corresponding intentions. These intentions to use condoms appear to derive from attitudes, subjective norms, and perceived behavioural control" (Albarracin et al, 2001).

It should be noted, however, that this study relies on the assumption that self-reported condom use is an accurate reflection of the participants' actual everyday behaviour. Another important limitation is that although studies like this are based on complex models and they quantitatively estimate the fit of the theoretical model to the observed data, they are still correlational. This means that the direction of causality, although plausible, is still just **inferred**. Is it possible, for example, that behaviour influences intentions rather than the other way around? Longitudinal studies in which intentions and behaviours are assessed at different points in time can provide valuable insights into the direction of causality in decision-making models.

Finally, it should be noted that the study had a lot of potential implications for HIV prevention efforts.

Exercise

Can you think of a way to test the predictions of the theory of planned behaviour in an experimental, rather than correlational, design? Suggest some ideas.

The adaptive decision-maker framework

There is an increasing recognition of the fact that **emotions** may influence our thinking and decision-making. The consequences of decisions result in experiencing certain emotions. The memory of such emotions, and the anticipation of them, may then become one of the driving factors in decision-making. One of the models that includes emotions in the process of decision-making is known as the adaptive decision-maker framework. Let's have a closer look at it.

In the classical information-processing approach which was dominated by normative models, the decision-maker was assumed to be completely **rational**, with complete knowledge and unlimited computational capacity. This was later doubted, first by acknowledging that human computational capacity is not unlimited, therefore descriptive models should account for "bounded human rationality" (Simon, 1955). We do not have the mental capacity to consider all aspects and nuances of a complex situation, evaluate and compare all the attributes of all the possible options, and accurately calculate risks and expected outcomes, especially under time constraints. So we should be using simpler decision-making strategies that use less cognitive resources.

The next step in the same direction was to say that apart from exhibiting bounded rationality, people actually don't always try to make rational choices—accuracy of decisions is not the only driving force behind human choices. One example of an alternative goal is minimizing the cost or effort involved in the decision (people are not only looking for the best decisions; they sometimes opt for the easiest).

The adaptive decision-maker framework (Payne, Bettman and Johnson, 1993) postulates that people possess a toolbox of strategies that may be used in thinking and decision-making tasks, so they may use different strategies in different situations. Some strategies for use when making a choice (considering a set of options or alternatives and picking the best one) are as follows.

- **Weighted additive strategy (WADD).** This strategy is considered to be normative for multi-attribute choice problems (choice problems involving multiple alternatives compared against multiple attributes). This is a maximizing strategy: for every alternative you multiply the value of every attribute by the importance (weight) of the attribute, then calculate the **weighted sum**, after which you choose the alternative where the weighted sum is the largest. In normative decision-making models (that mathematically justify the most rational choices) this is also known as calculating the "utility" of a choice (hence the name for the normative model, utility theory (see above)). This strategy requires a lot of effort.
- **Lexicographic strategy (LEX).** Choose the most important attribute and then the option that has the best value for that attribute. Undoubtedly, this strategy is not optimal (in that it simply ignores a number of attributes), but it has been shown that in a variety of situations this strategy is actually reasonable: under some circumstances it does not lead to a significant reduction in accuracy, yet does lead to a significant reduction in effort.
- **Satisficing strategy (SAT).** Determine a specific cut-off point for every attribute. Then consider the first option. For every attribute of this option, compare the value of that attribute to the cut-off point. If at least one of the attributes is lower than the cut-off point, reject the option and consider the next one. Stop when you reach an option that exceeds all the cut-off points. If no option passes the test, the cut-off points are relaxed and the process is repeated.
- **Elimination by aspects (EBA).** Choose the most important attribute and eliminate all the options that do not meet your requirements for this attribute. Then select the second most important attribute and eliminate more options. Continue until only one option remains.

Let's consider a hypothetical example. Imagine you are planning to meet some friends (some of whom are bringing children) at a restaurant and you are choosing from five options and against five attributes (quality of food, price, and so on). Each attribute may have one of three possible values: "bad", "average" and "good".

		Attributes				
		Quality of food	Price	Distance from home	Catering to a variety of dietary needs	Playroom for children
Alternatives	"Southern Sun"	Good	Average	Good	Bad	Bad
	"Northern Wind"	Bad	Good	Average	Average	Bad
	"Western Traditional"	Average	Bad	Bad	Bad	Good
	"Eastern Delicacy"	Average	Good	Average	Good	Bad
	"Global Junction"	Good	Average	Bad	Bad	Average

▲ Table 3.4 Hypothetical example for decision strategies

If you are using the WADD strategy, assign numerical values to attributes (for example, bad = 1, average = 2, good = 3) and then calculate the weighted sum of attributes for each of the alternatives. The score you get for "Southern Sun" is $3 + 2 + 3 + 1 + 1 = 10$. The restaurant that will score the highest is "Eastern Delicacy" ($2 + 3 + 2 + 3 + 1 = 11$). So this is the one you will choose.

If you are using the LEX strategy, first decide which of the attributes is most important to you (say, playroom for children) and then pick the best alternative for that attribute (in our case, "Western Traditional").

In SAT, decide on a cut-off score (for example, you decide that all attributes in the best choice should be at least average) and look for the option that satisfies this condition. If no such option is found (as is the case in the current example, since each of the alternatives scores "bad" for at least one of the attributes), relax the condition. For example, you might decide that the attribute playroom for children does not necessarily have to be good or average, and now "Eastern Delicacy" would satisfy your new condition and be the restaurant of choice.

In EBA, your thinking might be like this. Important attributes should be at least "average". The most important attribute is "quality of food". So you eliminate "Northern Wind". The second most important attribute is "catering to a variety of diets". So you eliminate three more restaurants. Only "Eastern Delicacy" is left, and this is the restaurant you choose.

Strategies like WADD and SAT are called **alternative-based**, because you are considering different attributes for the same alternative. Strategies like LEX and EBA are **attribute-based**, because you select an important attribute and compare different alternatives against this attribute. This will be important later in this section when we

consider the role of emotion in decision-making, since "alternative-based" strategies potentially involve more emotionally uncomfortable trade-offs (for example, in "Southern Sun" there's really great food, but there isn't a playroom for children).

Exercise

Think of some real-life examples in which:

- you predominantly use each of the four strategies
- some strategies are more emotionally uncomfortable than others
- trade-offs created by alternative-based strategies cause a negative emotional experience.

Of course, in real-life decision-making we do not consistently use one of the clear-cut strategies. In fact, we use a variety of strategies that might combine the four discussed above. What is important for the adaptive decision-maker framework is that people have a toolbox of strategies that they may or may not use depending on the situation.

So if people have all the strategies at their disposal (in the "toolbox"), how and why do they choose between them in a particular situation? Here is where emotions and other "irrational" factors come into play. According to the adaptive decision-maker framework, **strategy selection is guided by goals**. There are **four meta-goals** proposed in the framework.

- **Maximizing decision accuracy.** This is the only goal assumed in normative choice models. Making a choice between the four strategies outlined above, an individual who focuses on maximizing the accuracy of the decision would

prefer the WADD strategy, making an attempt to quantify all attributes and consider all possible attributes for all possible options.

- **Minimizing the cognitive effort.** Of the above-mentioned strategies, LEX is probably the most energy-saving, since it only involves two quick steps.
- **Minimizing the experience of negative emotion.** In real-life decision-making, some attributes or options can be emotion-laden. For example, you are choosing a car and you have ruled out one of the brands because its name creates unpleasant associations in your language. (This was the case with the Russian car brand "Zhiguli" which had to be renamed because to the European ear it sounded like "gigolo", dramatically decreasing sales.) In another example you are choosing a house and you see one that exceeds your expectations, but you are not going to buy it because a violent crime happened in it several years ago. How can negative emotions impact decision-making? There are two competing hypotheses.
 - Hypothesis A—the negative emotion will interfere with the decision, compromising both the speed and accuracy of the decision. In this hypothesis emotion is not part of a decision-making model. Rather it is an external factor that has a negative impact on the process.
 - Hypothesis B—decision-making will directly adapt to the negative emotion. In this case, emotion should be included in decision-making models as an integral part, since accounting for emotions would help us better understand and predict choice outcomes. As will be shown later, hypothesis B gained empirical support in research studies.
- **Maximizing the ease of justification of a decision** (to others or to oneself). The authors

Research in focus: Methods of research for micro-level cognitive models

These methods allow a deeper insight into the nature of separate acts of decision-making, an insight into the process rather than the outcomes of this process.

- **Computer simulations:** these can be performed **without human subjects**

(which is simultaneously an advantage and a disadvantage). In computer simulations various hypothetical decision-making scenarios are typically programmed and then various decision strategies (for example, WADD, SAT, EBA) are compared

of the adaptive decision-maker framework argue that inclusion of this meta-goal explains a number of effects that had been established in research but could not be explained by existing thinking and decision-making models. One example is the so-called asymmetric dominance effect which you will learn about later in this unit (see "Biases in thinking and decision-making").

ATL skills: Thinking

How does this model link to the principles of cognitive approach to behaviour? In particular, how does the model relate to principle 3 (cognitive processes do not function in isolation)?

There's one important difference between the adaptive decision-maker framework and the theory of reasoned action. The theory of reasoned action is an example of a **macro-level decision-making model**. It focuses on the choice outcomes (for example, condom use) and relatively stable characteristics (such as attitudes, perceived norms) that might predict these outcomes. In other words, the theory deals with results of decisions on a large scale. On the other hand, the adaptive decision-maker framework is an example of a **micro-level model**. It focuses on the process of making a decision, the strategies being used when processing available information, and so on. Such models zoom in on decision processes on a smaller scale.

Undoubtedly, micro-level models attempt to describe processes that are more **situation-dependent, fluid and complex**. With such complex and transient objects of research, collecting self-report measures and analysing correlation patterns is no longer a valid method. There should be other methods that allow a deeper insight into the nature of separate acts of decision-making, an insight into the process rather than the outcomes of this process.

Research in focus (continued)

in terms of decision accuracy. To compare the performance of different strategies, a normative model is used as a point of reference (in this case WADD can be taken as the normative model since it provides the most comprehensive analysis of alternatives). This allows the researcher to quickly (and without the need to actually involve human subjects) change the starting parameters of the situation (for example, the number of attributes and alternatives) and run multiple comparisons. It makes possible such conclusions as: "In decision sets with little trade-off between attributes and a small number of alternatives WADD and LEX perform equally well". The researcher can also make these computer models more complicated by adding hypothetical variables that model genuine human behaviour. For example, they may introduce a hypothetical "tendency to avoid emotion-laden decisions" or computational constraints (for example, no more than 7 ± 2 units of information). This is done on the basis of prior research. Of course, conclusions and inferences derived from such simulations are only hypothetical, but they provide a lot of insights for subsequent experiments that may involve human subjects and compare their behaviour to that predicted by the computer model.

- **Verbal protocols:** another name for this technique is "think-aloud protocols". Subjects are asked to give continuous verbal reports while performing a task, that is, to think aloud. For example, you may be given a mathematical problem and asked to solve it, but at the same time never stop verbalizing everything that is going on in your mind. Transcripts of such think-aloud sessions are then analysed with the aim of deriving some clear-cut stages or strategies in the decision-making process.
- **Monitored information search:** in this method the process of information acquisition by the participant is monitored and recorded. The assumption is that this "trajectory" of information acquisition will reflect your decision-making processes: you will look at those bits of information that are most important to you at this moment while making the choice. Typically researchers will register what information is sought, in what order, and for how long each piece of information is processed (reaction time). This can take the form of software that records the movements and clicks of a mouse cursor, or sophisticated techniques such as eye-movement tracking.
- Of course, **neuroimaging techniques** are also used to shed light on the neuronal mechanisms of decision-making.

We will consider one example of a study that used **monitored information search** to test the prediction that decision-making directly adapts to negative emotions ("hypothesis B" above).

Luce, Bettman and Payne (1997) hypothesized that task-related negative emotion will encourage decision-makers to process information more extensively (because they attach more importance to the accuracy of decision) and at the same time

in a way that avoids emotionally difficult trade-offs between options.

Twenty-seven undergraduate students were asked to imagine they were members of a charity that provides children with financial support. Their task was to choose one child from a group of five children described in terms of five attributes (see the table below):

Child	Willingness to learn	Age	Personality	Family size	Living conditions
Sang	Poor	Prefer	Good	6 people	Bad
Rene	Very good	Prefer	Average	3 people	Adequate
Zivae	Very good	Prefer	Very poor	6 people	Adequate
Kito	Very poor	Indifferent	Very good	4 people	Very bad
Jaime	Very poor	Don't prefer	Poor	7 people	Very bad

▲ Table 3.5 Based on Luce, Bettman and Payne (1997, p 391)

The importance of the attributes was explained in the following way.

- Willingness to learn and personality are important because children who score better on these attributes would be more likely to help others in their community.
- Age is important because a relationship will have to be established with the child through correspondence which requires a certain maturity.
- Family size is important because the entire family benefits from the charity.
- Living conditions are important because the charity should target children living in relatively worse conditions.

You will see that the attribute values conflict with each other—there is no dominant alternative, that is, an alternative that would be best across all the attributes. The task was performed by using the “Mouselab” computer program. In this software the choice was presented to the subjects in the form of a matrix (much like Table 3.5), but all information in the cells was hidden behind boxes that could be opened by a mouse click. The software recorded the order in which boxes were opened, the time spent in each box, and the final choice. The order in which boxes were opened was observed through counting the number of times subjects used two patterns:

- after opening box A, opening a box for the same alternative but a different attribute (alternative-based transitions)
- after opening box A, opening a box for the same attribute but a different alternative (attribute-based transitions).

Attribute-based transitions involve fewer trade-offs and so theoretically they help you to avoid making emotion-laden choices. For example, if you open the box saying that Kito’s personality is “very good”, it could be emotionally difficult for you to find out that Kito’s willingness to learn is “very poor”, since it creates a trade-off and poses a difficult dilemma. However, it is emotionally easier to avoid such trade-offs and open “personality” boxes for other children.

In order to manipulate negative emotion, participants were split into two groups.

- In the higher-emotion group participants were provided with a more specific and extensive background text describing the children’s situation. They were also told that the four eliminated children were not likely to receive support anywhere else. This was meant to enhance the perception of the choice as high-stakes.
- In the lower-emotion group the background texts were more superficial and participants were told that the four remaining children were likely to receive support elsewhere.

Results of the study supported the pattern that was predicted by the adaptive decision-maker framework.

- Participants in the higher-emotion group opened a larger number of boxes and spent more time on the task (which shows that they were processing information more extensively, probably due to more importance attached to the accuracy of decisions).
- Participants in the higher-emotion group engaged more frequently in attribute-based transitions (which shows that they were avoiding emotionally difficult trade-offs between options).

Exercise

Make a schematic representation of this study outlining its main elements and results.

Do not forget to include:

- aim
- hypothesis
- independent variable (IV), dependent variable (DV)
- operationalization of IV and DV
- procedure
- result
- conclusion (link results back to the hypothesis).

Psychology in real life

On 24 April 2013 an eight-storey commercial building named Rana Plaza collapsed in Dhaka, Bangladesh. It is now considered the deadliest accidental structural failure in modern history. Approximately 2,500 people were rescued from the building alive, while the search for the dead lasted three weeks with a total death toll of 1,129. The building housed multiple garment factories, several shops and a bank. On 23 April reporters found cracks in the foundation of the building, the footage of which appeared in the news on a television channel. Immediately after that the building was evacuated, and the shops and the bank on the lower floors were closed. However, later that day the owner of the building made an announcement to the media saying that the building was safe and the workers should return to their workplace tomorrow. Workers were also threatened with loss of monthly salary if they failed to return to the factories. On the morning of the following day there was a power outage in the buildings, and back-up generators were started to keep the factories running. The building collapsed at 8.57am.

Thirty-eight people were charged with murder, and the building owner was caught trying to flee across the border to India.

Apart from the decision to force workers to return to their workplace, charges were filed on the basis of numerous violations in the construction of the building itself: it was built on a filled-in pond, it was converted from commercial to industrial use, and three floors were added above the original permit.

Apart from numerous legal and moral issues, all this raises a lot of questions regarding how people make their decisions and why these decisions can turn out to be so irrational.

<https://tinyurl.com/hpg5125>



Reliability of cognitive processes: reconstructive memory

Inquiry questions

- Is memory passive retrieval of information from the long-term store, or rather active reconstruction of information from the past?
- Does external information influence the way we remember things?
- Can memory of an event change with the course of time?
- How are false memories created?

What you will learn in this section

- Unreliability of memory
 - Schema influences what is encoded and what is retrieved
 - Memories can be distorted
- The theory of reconstructive memory: post-event information may alter the memory of an event
 - Loftus and Palmer (1974) experiment 1: eyewitness testimony, two competing explanations: response bias and genuine memory change
 - Loftus and Palmer (1974) experiment 2: support for the genuine memory change explanation.
- Verbal post-event information can interfere with visual information obtained originally; this alters not only recall but also visual recognition
 - Support: Loftus, Miller and Burns (1978)
- However, when misleading information is not an option on the test, the effect disappears; this takes us back to the alternative explanation: response bias
 - Support: McCloskey and Zaragoza (1985)
- Meta-analysis as a way to resolve contradictory research
 - Payne, Toglia and Anastasi (1994): showed that genuine memory change occurs even when misleading information is not an option on the test; however, the effect is small
- Research in naturalistic settings contradicts the theory of reconstructive memory, but may be explained by another memory mechanism: flashbulb memory
 - Yuille and Cutshall (1986)

This section also links to:

- schema theory (memory may be changed during storage, processing and retrieval)
- flashbulb memory
- principles of the cognitive approach to behaviour—biases in cognitive processes can be systematic and predictable
- research methodology.

show that schemas can determine what you do and do not remember even after the information has been coded and stored in the long-term memory. Depending on the schema you are using, you will find it easier to recall some details. This shows one

Unreliability of memory

We have already considered the way that schemas may influence memory processes at all stages of information processing, including encoding and retrieval. Studies like Anderson and Pichert (1978)

of the limitations to reliability of memory: retrieval of information from LTM may depend on whether or not you are using a particular schema. This is why we sometimes find it difficult to recall things, but then they “jump back” to us when the context changes and something in the new context triggers those memories.

However, the fact that retrieval (or non-retrieval) of information depends on schemas in use is only one dimension of unreliability of memory. Another dimension is the tendency of memory to be **distorted**. Is it possible that we recall something, but it never actually happened? Or it did, but not quite the way we remember?

The theory of reconstructive memory and eyewitness testimony

There’s a theory that proposes that memory, rather than being the passive retrieval of information from the long-term storage, is an **active process** that involves the reconstruction of information, the theory of **reconstructive memory**. Reconstruction literally means that you construct the memory again.

ATL skills: Self-management

Think about one of your early childhood memories, something that happened to you when you were very young. How clearly do you remember this episode? Some details are probably more accessible to you than others, and you remember those clearly. Some details are a bit vague. Some details or contextual information is not available, there are gaps.

Now imagine you were to tell this childhood memory to someone else. To make the story more coherent, you might want to fill in some gaps with details that seem logical to you, for example, if this happened in the morning and you were on your way somewhere, you were probably on your way to school. The next time you retell this story, you will be more likely to mention that you were on your way to school, and what’s more, you will think you are **remembering** it. Interestingly, the more often you recollect (reconstruct) your childhood memories, the less accurate they can become!

In order to see the extent to which memories can be altered by irrelevant external influences, **Loftus and Palmer (1974)** conducted their

famous study on **eyewitness testimony**. It is important to note that the study actually consisted of two parts—experiment 1 and experiment 2—because there were two competing hypotheses.

In **experiment 1**, 45 students were split into 5 groups and shown film recordings of traffic accidents (each participant was shown 7 films). The order in which the films were shown was different for each participant. Following each film, participants were given a questionnaire asking them to answer a series of questions about the accident. Most of the questions on the questionnaire were just meant as distracters, but there was one critical question that asked about the speed of the vehicles involved in the collision. This question varied among the five groups of participants: one group was asked “About how fast were the cars going when they hit each other?”, and for the other groups the word “hit” was changed for “smashed”, “collided”, “bumped” or “contacted”. Results showed that the mean speed estimates varied significantly for the five groups:

Verb	Mean speed estimate (mph)
Smashed	40.5
Collided	39.3
Bumped	38.1
Hit	34.0
Contacted	31.8

▲ Table 3.6 Findings from Loftus and Palmer (1974)

The accuracy of estimates here does not really matter: numerous studies had previously shown that people in general are not very good at judging how fast a vehicle is travelling. The crucial point, however, is that all participants watched the same films, and yet they gave significantly different mean speed estimates.

Loftus and Palmer suggested that this finding could be interpreted in two possible ways.

- **Response bias:** for example, a subject might be uncertain whether to say 30 mph or 40 mph, and a verb of a higher intensity (such as “smashed”) biases the response to a higher estimate. Memory of the event in this case does not change.
- **Memory change:** the question causes a change in the subject’s memory representation

of the accident. For example, the verb "smashed" actually alters the memory so that the subject remembers the accident as having been more severe than it actually was.

To choose between the two competing explanations, Loftus and Palmer conducted **experiment 2**. The rationale behind the second study was that if memory actually undergoes a change, the subject should be more likely to "remember" other details (that did not actually occur, but fit well into the newly constructed memory).

Discussion

Before you read about experiment 2, can you devise your own experiments? How would you design an experiment to choose between the two competing hypotheses?

Split into groups and then discuss each other's ideas.

In **experiment 2**, 150 students participated. They were shown a film depicting a multiple-car accident. Following the film, they were given a questionnaire that included a number of distracter questions and one critical question. This time participants were only split into three groups: "smashed into each other", "hit each other" and a control group (that was not asked the critical question). One week later the subjects were given a questionnaire again (without watching the film). The questionnaire consisted of 10 questions, and the critical yes/no question was "Did you see any broken glass?" There had not been any broken glass in the video. Results showed that the probability of saying "yes" to the question about broken glass was 32% when the verb "smashed" was used, and only 14% when the word "hit" was used (which was almost the same as the 12% in the control group). So, a higher-intensity verb led both to a higher speed estimate and a higher probability of recollecting an event that had never actually occurred.

Based on this result, the authors concluded that the second explanation for experiment 1 should be preferred: an actual change in memory, not just response bias!

In line with the theory of reconstructive memory, Loftus and Palmer suggest that memory for

some complex event is based on **two kinds of information**: information obtained during the perception of the event and external post-event information. Over time, information from these two sources is integrated in such a way that we are unable to tell them apart. Applied to the study, this means that subjects who were given the question with the verb "smashed into" used this verb as post-event information suggesting that the accident had been severe. This post-event information was integrated into their memory of the original event, and since broken glass is commensurate with a severe accident, these subjects were more likely to think that they had seen broken glass in the film.

These findings can also be interpreted from the perspective of schema theory: the high-intensity verb "smashed" used in the leading question activates a schema for severe car accidents. Memory is then reconstructed through the lens of this schema.

ATL skills: Communication

The theory of reconstructive memory and research into the reliability of eyewitness testimony has triggered many social and even political campaigns related to legal practices. These revolved around cases where accusations were made based on eyewitness testimony alone, as well as the phenomenon of false memories.

Go online and find out more about the scope of this problem and changes that have been implemented in some countries.

Prepare a short presentation based on the results of your search.

Misleading information, recognition and visual memory

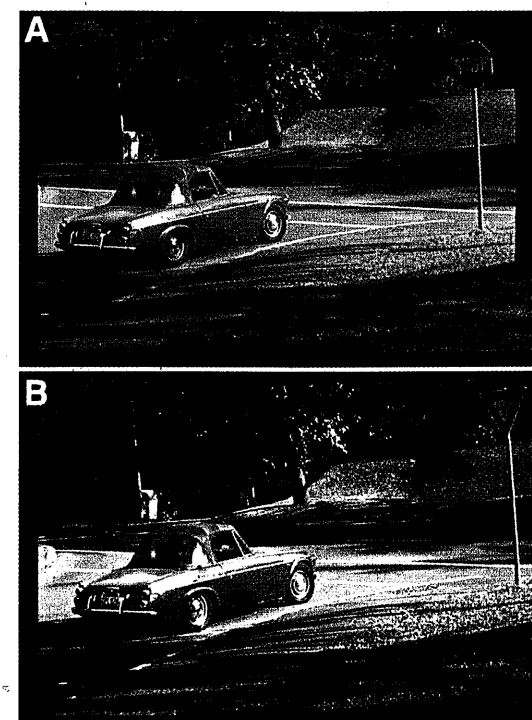
In Loftus and Palmer (1974) post-event information was verbal and the response to the experimental task (answering a question about broken glass) was also verbal. Some critics pointed to this as a limitation of the study, because visual and verbal information might be stored separately, and the leading question might have interfered with the verbal storage but not the visual one. So, it remained to be seen whether or not verbal post-event information could be integrated with visual information obtained originally at the time of the event.

Another argument against applicability of these results to natural conditions is that real-life eyewitness testimony often involves **recognition**

(recognizing a stimulus as something you had already seen) rather than **recall** (in the absence of a stimulus). Eyewitness testimony is often required in recognizing individuals suspected of committing a crime. Also in the previous example we saw that leading questions (with verbs of varying emotional intensity) may provide post-event information that contributes to reconstructive memory. In real-life situations, however, post-event information might take more aggressive forms, for example, providing a person with **misleading information**. This might happen in police interrogations or in the presence of other conflicting testimonies.

How reliable is (reconstructive) memory in the event of recognition and in the presence of misleading information? Also, can verbal post-event information interfere with visual information obtained originally?

Loftus, Miller and Burns (1978) carried out an experiment with the aim of investigating how verbal information supplied after an event influences a witness's visual memory for that event. In the recognition procedure, 195 students from the University of Washington were shown a series of 30 colour slides depicting successive stages in a car-pedestrian accident. The slides featured a red Datsun travelling along a side street toward an intersection with either a **stop sign** (for half the subjects) or a **yield sign** (for the other half). These two critical slides are shown below.



▲ Figure 3.16 Critical slides from the recognition task

In the remaining slides, the Datsun turned right and knocked down a pedestrian who was crossing at the crosswalk. After viewing the slides, the subjects answered a series of 20 questions. Question 17 on the list was either "Did another car pass the red Datsun while it was stopped at the stop sign?" for half the subjects or the same question with the words "stop sign" replaced by "yield sign" for the other half. This resulted in a **2-by-2 experimental design**:

Sign in the slides:	Sign in the question	
	Stop	Yield
Stop	Group 1 (consistent information)	Group 2 (inconsistent information)
Yield	Group 3 (inconsistent information)	Group 4 (consistent information)

▲ Table 3.7 Groups in Loftus, Miller and Burns (1978)

ATL skills: Research

What is a 2-by-2 experimental design? If you cannot recall, review Unit 1 on research methodology.

Note that in order to test the hypothesis in this experiment groups 1 and 4 (combined) were compared to groups 2 and 3 (combined).

As you can see, half the subjects received consistent post-event information while for the other half this information was inconsistent with their actual visual memories. After a filler activity, a **forced-choice recognition test** was administered in which subjects were required to pick the slide they had actually seen from a pair of slides.

Results indicated that subjects who received misleading post-event information were able to correctly recognize the slide actually seen in 41% of the cases, whereas subjects who received consistent post-event information made a correct choice in 75% of the cases.

In a variation of this experiment, both the questionnaire and the recognition task were administered not immediately but a week later. Correct recognition of the slide in the inconsistent-information group in this case was even less likely.

In other words, misleading post-event verbal information was integrated with visual information from before, which resulted in reconstructive

memory. The more time passes from the moment of the original event, the stronger effect misleading information has on our visual memory. This finding answered the visual-verbal controversy from before: verbal post-event information actually can integrate with visual information and alter it.

Exercise

Compare the two studies (Loftus and Palmer, 1974; Loftus, Miller and Burns, 1978) in terms of their:

- independent variable (IV)
- dependent variable (DV)
- operationalization of IV and DV
- conclusions.

Make a table and formulate these elements for both studies using full sentences. Be careful with terminology.

Back to alternative explanations: response bias

However, even the results of this study can be doubted. **McCloskey and Zaragoza (1985)** suggested an alternative explanation and claimed that the results might have been obtained due to response bias, not an actual change in memory (back to the conflicting hypothesis in Loftus and Palmer's experiment 1). McCloskey and Zaragoza used the same slide-recognition procedure but introduced one crucial change. In one of their studies, subjects (undergraduate students) were presented with a

Group	Saw in the slides:	Narrative referred to:	Forced choice between	% correct
1 (control)	Hammer	Tool	Hammer and either wrench or screwdriver (randomly)	69
2	Hammer	Wrench	Hammer and wrench	40
3	Hammer	Wrench	Hammer and screwdriver	66

▲ Table 3.8 Findings from McCloskey and Zaragoza (1985)

In the control group, the object from the slides was correctly recognized by 69% of participants. This is higher than you would expect by chance if you assume that subjects do not remember, so they are guessing (50%).

In the second group (which followed the logic of the previous studies) the correct object was chosen by 40% of participants, lower than

series of 79 colour slides depicting a maintenance man entering an office, repairing a chair, finding and stealing \$20 and a calculator, and leaving. The slide sequence included four critical slides. For each of these slides there were three different versions. For example, in one of the critical slides the tool picked up by the maintenance man was different: a hammer, a wrench or a screwdriver. After this, the subjects were required to read a narrative giving a detailed description of the incident. Some information in the narrative was misleading. For example, half of the subjects who saw a hammer in the slides received a narrative referring to it simply as a tool (control condition), whereas the other half received a narrative mentioning either a wrench or a screwdriver (misled condition).

Up to this point, the procedure is essentially similar to that of Loftus, Miller and Burns. However, the crucial difference was in the way the forced-choice recognition test was designed. In this test, some of the misled participants were given the misleading option along with the original one, whereas others were given the original option and a third option. For example, a group of participants saw a hammer in the slides and then later read about a wrench in the narrative (misleading information). In the forced-choice test, some of these participants would be asked to choose between a hammer and a wrench and others would be asked to choose between a hammer and a screwdriver. Note that for these participants the screwdriver appeared neither in the slides nor in the narrative.

To outline the key comparison that was the focus of the study, let's look at the example in the table below:

you would expect by chance. According to the classical interpretation (Loftus, Miller and Burns), this would mean that misleading information integrated with the prior visual information and distorted it (at least in some participants).

In the third group, however, the percentage of correct responses was 66, practically no different from the control condition.

On the basis of these findings McCloskey and Zaragoza claimed that the presentation of misleading information (wrench) did not have an effect on the original memory. They argued that the lower number of correct responses in group 2 might be explained by the fact that some participants forgot the details from the slides, and the narrative simply filled in that gap (but it did not change their memory). When given the test later, they might have shown response bias, that is, they were more likely to report having seen a wrench even though they did not remember seeing it. However, when the misleading information is not an option on the test, participants perform just as well as those in the control group, which seems to indicate that their original memory was not modified or distorted in any way.

Discussion

Memory change or response bias? Organize a debate.

Split into two groups. Each group adopts one of the two positions. Take your time to study the empirical evidence and come up with arguments in support of your position, as well as potential counter-arguments for the opponents' standpoint.

Do not forget to back up your arguments with empirical evidence.

Meta-analysis

We have looked at three eyewitness testimony studies and we have seen how these studies represent a history of **contradictory** research. This is not surprising at all. In fact, finding flaws with previous research is a driving force of scientific discovery, not only in psychology. In crucial topics like this, multiple research studies that seem to contradict each other is a common occurrence. A common way to resolve such contradictions is to conduct a **meta-analysis**.

TOK

1. How is contradictory research resolved in other areas of knowledge?
2. How does this relate to the concept of paradigm shifts?
3. Are meta-analyses possible in other areas of knowledge? What are the limitations of meta-analyses?

Payne, Tolia and Anastasi (1994) conducted a meta-analysis of 44 research studies that used the "modified recognition test", the same procedure that was used in McCloskey and Zaragoza (1985), when the misleading information was not an option on the test. When all the studies were combined, the average recognition level in the misled condition was lower than the average recognition level in the control condition (71.7% versus 75.8%). This is a small difference, but it was **statistically significant**. The authors concluded that the misinformation effect exists even in the "modified recognition test", although this effect is not robust across all the studies. The data from the meta-analysis were also used to see whether there is a relationship between the misinformation effect and the length of the retention interval. Results showed that the longer the retention interval, the more likely the misinformation effect.

ATL skills: Research

"This is a small difference, but it was statistically significant".

What does this mean exactly? Can you name other examples from psychology where results were "weak" but "significant"?

Refer back to Unit 1 on research methodology and make sure that you remember the meaning of the concepts "effect size" and "statistical significance".

Research in naturalistic settings

Another common point of criticism of this whole area of research is its artificiality and the resulting lack of ecological validity. There are a number of research studies that looked at eyewitness testimony in **naturalistic settings**. Having the advantage of higher ecological validity, these studies tend to lack internal validity: when you observe your subjects in real-life settings, you inevitably lose control of a number of potentially confounding variables.

ATL skills: Research

"There's a trade-off between internal and external validity of an experiment".

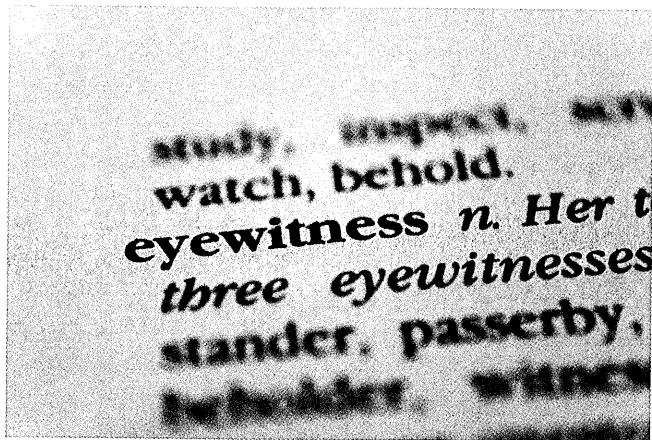
Explain why. Refer back to Unit 1 on research methodology.

One example of such research is **Yuille and Cutshall (1986)**. Participants in this study were eyewitnesses to a real crime in Vancouver. A thief entered a gun shop, tied up the owner, stole money and guns, and left. The owner managed to free himself, get a revolver and go outside. Gunshots followed, resulting in the thief being killed and the store owner injured. The shooting was witnessed by 21 people from various viewpoints. They were all interviewed by the police. Thirteen of them agreed to participate in scientific research approximately four months after the incident. Interviews were used to collect data, but experimental elements were also used (half the participants were asked leading questions whereas the other half were not). Results of the study showed that the misleading questions had very little effect on recall. Generally, participants correctly recalled a large number of accurate details. The accuracy of eyewitness accounts was carefully established by comparing them to the official police records.

However, the authors admit that this field study might have tapped into a separate and independent memory mechanism: **flashbulb memory**. This occurs when an incident is accompanied by a strong emotional reaction on

the part of the viewer. Flashbulb memory will be the focus of discussion later on in this unit (see "Flashbulb memory").

Overall, eyewitness testimony research has sparked a lot of debate. The practice of using eyewitness evidence in courts has been attacked by psychologists and forensic specialists who claimed that memories can be unreliable and manipulated. This has influenced the legal systems and juridical practices in many countries around the world. Research into the reliability of eyewitness testimony sheds light both on a number of flaws in court practices and on reliability of memory as a cognitive process.



Psychology in real life

Paul Ingram was an active Christian, well-known and respected in his community in Washington State. He was a deputy sheriff and Chairman of the local Republican party. It all changed in 1988 when his two daughters accused him of sexual abuse. After months of interrogation Paul confessed and pleaded guilty without trial. He provided many vivid descriptions of his crimes.

When Paul was interrogated by the police, he said at first that he had no memories of the abuse. At the same time, he said that he didn't raise his daughters to lie. Investigators and court-appointed experts told him that it was common for child abusers to be in a state of denial and suppress memories of their crimes. Paul's pastor conducted an exorcism ritual and confirmed that Paul had an evil side. He advised Paul to pray to the Lord for his memories to return. As Paul prayed, he began to see images of him abusing Ericka and Julie when they were little. The police asked for details, and details followed, very vivid, including the set-up of the room and the time on the clock.

Then the girls' claims grew stronger. They said they had been victims of more than 800 satanic rituals that involved more than 30 members of the sheriff's department, and that they were impregnated several times and given abortions by their father. They claimed they had many scars from the violent rituals. They also drew maps to show where on Ingram property the satanic rituals had been taking place. They said they had witnessed more than 30 murders and burial of the bodies.

Despite a very extensive search, none of these claims could be supported by evidence, such as medical examination and even excavation of Ingram properties.

Psychology in real life (continued)

Finally, Dr Richard Ofshe, an expert in "cult behaviour", was hired to investigate the case. He conducted extensive interviews with both Paul and his daughters and became convinced that the daughters were not telling the truth and Paul had been manipulated into developing false memories. To test this, he met with Paul and told him that Ericka and Julie described an episode when Paul forced incest between one of them and one of their brothers while he was watching. In fact, Ofshe had made this episode up. Paul told Ofshe he could not remember the incident. Ofshe asked Paul to return to his cell and pray about it in the same way that he used to recover his other memories. What followed several months later was a detailed written confession to an incident that only existed in Paul's mind. However, this "experiment" was not taken by the court seriously. Paul was sentenced to 20 years in prison. He remained in jail until 2003.

<https://tinyurl.com/kamdcjv>

