6 Critical thinking

In an essay, you are expected to think critically about issues or theories in psychology, to propose an argument, and to evaluate it. In a report, you are expected to think critically about theories or models in psychology, to propose a hypothesis, and to evaluate it. Your argument or hypothesis is commonly about what factors cause some particular behaviour. Below, I attempt to guide you toward thinking critically, identifying causation, and understanding types of arguments and hypotheses, and to guide you away from bad arguments.

6.1 Thinking critically

Zechmeister and Johnson (1992) set out some criteria for critical thinking. Let us take a question that you might be asked to think critically about: Why does prejudice exist? I have chosen this question because the moral offensiveness of prejudice threatens most of the criteria. You are likely to think critically if you:

- have *intellectual curiosity,* that is, you want to know the truth, what makes people "tick" (e.g., you want to know why prejudice exists, rather than getting stalled by its negative aspects);
- are *objective,* that is, you look at evidence rather than responding emotionally (e.g., you read laboratory studies, rather than accounts of the people involved, or at their reactions to prejudice);
- are *open minded,* that is, you are willing to look at all sides of the issue, rather than just one (e.g., do only some people exhibit prejudice [a personality approach] or does everyone exhibit prejudice because it fulfils some socially beneficial functions [a situational approach]?);
- are *flexible,* that is, you are willing to change your position if the evidence warrants it, or to change your method of inquiry if it seems to be fruitless (e.g., if you find that the personality approach to prejudice has been shown to be wrong, you then pursue the situational approach);
- are *intellectually sceptical,* that is, you accept others' arguments only if they are logical, complete, and supported by definitive studies (e.g., you would accept someone's argument that prejudice is useful if the person established that prejudice's positive aspects outweighed its negative aspects [logic], enumerated all the positive and negative aspects [complete], and cited studies documenting the various effects [supported]);
- are *intellectually honest,* that is, you accept evidence and entertain arguments even if they contradict your own beliefs; in other words, you are just as sceptical about your own position as you are about others' (e.g., you recognise that some of your own behaviours are prejudicial);
- are *systematic,* that is, you pursue each argument to its logical conclusion;
- are *persistent,* that is, you attempt to resolve all inconsistencies in each argument; and
- *respect others' viewpoints,* that is, you are willing to admit that you are wrong and others are right.

You will think critically if, when you are told something (e.g., "prejudice is today's major social problem"), you ask questions such as:

1. Who says? (You need to know this to find the person's written reasons.)
2. Is this the person's opinion, someone else's idea, or does the person have evidence?
   (a) If it is an opinion, be suspicious. Ask: Is it a sound opinion? (See 6.5.3.)
   (b) If it is someone else's idea, go back to Question 1.
   (c) If there is evidence, go to Question 3.
3. Is the person's evidence sound?
4. Are there any other interpretations of the evidence?

In the remainder of this chapter, I give you some techniques that may help you think critically. But thinking critically is a skill that must be acquired through practice. Your courses and reading in psychology will expose you to the critical thinking of others. Emulate these others. Question everything. Accept only what can be shown to be true.

6.2 Identifying causation

6.2.1 Basic principles of a psychology experiment

A major concern of many studies in psychology is to identify causation. The only studies that allow causation to be inferred correctly are *experiments* embodying three principles:

1. At least two groups of individuals are formed by random assignment.[1]
2. Each group is treated identically except for the variable being manipulated: the *manipulated variable* (also known as the *independent variable*).[2] Often one group, a *control* group, gets no manipulation.
3. The groups differ reliably in response to the *measured variable* (also known as the *dependent variable*).

Let us imagine that you want to determine whether watching violent television predisposes (or causes) a child to be aggressive. An experiment that incorporates the three principles might be:

1. Children are randomly assigned into violent-television-viewing and non-violent-television-viewing groups. This could be achieved by, say, flipping a coin for each child: a head means the child goes into the violent group, and a tail means the child goes into the non-violent group.
2. Children in the two groups are seen by the same experimenter for the same lengths of time in the same room and watch the same television set. These aspects are all identical for the two groups. The only difference is that members of one group see a violent television program, whereas members of the other group see a non-violent television program. This is the manipulated variable. The programs have the same duration, interest, and arousal level, again being aspects in which the two groups are treated identically. All children then have an identical session of free play in which an observer counts the

1 For simplicity, we will not consider here experiments in which people participate in more than a single experimental condition. Such within-subjects, or repeated-measures experiments have their own specialised procedures for allowing causation to be inferred validly.

2 Experiments can have more than one manipulated variable. The levels of the manipulated variables must be combined *factorially;* we will confine ourselves to the simple, single-factor, experiment for our illustration.

number of aggressive acts committed by each child. The number of aggressive acts represents the measured variable.

3. If the mean numbers of aggressive acts differ reliably between the two groups, then we may conclude that the difference in the content of the two television programs caused the difference in aggressiveness.

If any one of the three principles is violated, causation cannot be inferred.

6.2.2 Problems with nonrandom assignment

Anything other than random assignment may create *confounding* variables: variables that change along with the treatment conditions. Confounding variables represent the most serious problem that can occur with an experiment, making it essentially worthless. If there is a confounding variable, it is impossible to tell without doing another experiment whether any differences in the measured variable are from the manipulated variable or from the confounding variable.

With nonrandom assignment, the confounding variables reside in the different characteristics of individuals. For example, if the researcher decided to assign boys to see the violent program and girls to see the non-violent program, then gender would be a confounding variable. Maybe boys are simply more aggressive than girls. If the researcher asked all the children who wanted to go first to raise their hands, and assigned those children to the violent program and reticent children to the non-violent program, then another confounding variable would have been created. Maybe assertive children are more aggressive than reticent children.

Another confounding variable from nonrandom assignment would arise if the children knew about the two conditions, and chose which condition they joined. This is called the problem of *self-selection*, and it yields *correlational studies*. Perhaps aggressive children are more likely to choose the violent-television condition than nonaggressive children. While this might seem far-fetched for the experiment we are considering, self-selection is a problem with much *survey research*. For example, let us say that a researcher surveys children and shows that children who watch more hours of violent television are more aggressive than children who watch fewer hours of violent television (i.e., aggression and watching of violent television are correlated). The researcher could not validly conclude that watching violent television predisposes a child to be aggressive because of the problem of self-selection. Aggressive children may simply choose to watch violent television more than nonaggressive children.

For another example of how correlational studies involve self-selection, consider the correlational finding that people who smoke suffer more heart disease than people who do not smoke. There is self-selection in that people choose to smoke, rather than being randomly assigned to smoking and no-smoking conditions. There may be some other cause of both the "manipulated" (smoking) and "measured" (heart disease) variables. Maybe stress causes people to smoke, and to suffer heart disease, rather than smoking causing heart disease.

6.2.3 Problems with nonidentical treatment

When groups are treated differently in more ways than just by the manipulated variable, confounding variables are created. If the violent-television condition was run in the morning and the non-violent-television condition was run in the afternoon, then the two conditions differ in time of day as well as program content. Time of day is a confounding variable. It could be a plausible cause of the differences in the measured variable, because children may simply be more active in the morning (thereby emitting more behaviour of any sort, including aggression, in the free-play session) than in the afternoon, when children might be tired.

better to be a lion for a day or a lamb for a year?". Each side of this debate (i.e., "It is better to be a lion than a lamb", and "It is better to be a lamb than a lion") would constitute an argument. Whether the assertion is actually true is irrelevant for a debate but not for an essay. For an essay, propose an argument that your reading and thinking convince you to be true. The goal of science is truth, not defence of an incorrect theory.

I show some examples of arguments for psychology essays in Table 6.1. To introduce these arguments into an essay, you would precede each one with words such as "In this essay, I will argue that …".

Table 6.1
Examples of Legitimate (although not necessarily correct) Arguments

Human handedness is learned
There is no intellectual decline in old age
Situational factors determine more of human behaviour than personality
The research on [this particular topic] is beset with methodological problems preventing any firm conclusion
Human perception is bottom-up
IQ tests do measure intelligence

An argument must also have the potential for disagreement. In Table 6.2, I give examples of assertions that fail on this criterion. There are two broad sorts of argument: *deductive* and *inductive.*

6.4.2 Deductive arguments

The simplest deductive argument is the *syllogism*, in which there are two *premises* and a *conclusion*. In deductive arguments, premises are statements about the world couched in absolute terms (e.g., "All", "Every", "Always") or in unambiguous comparisons (e.g., "A is bigger than B"). The sorts of conclusions that can validly follow such premises are determined by the rules of formal logic.

An important distinction is between *valid* and *sound*. A conclusion is valid if it follows logically from its premises. A conclusion is sound if it is valid and all its premises are true.

Table 6.2
Examples of Assertions that are not Arguments

Assertion	**Why it is not an argument**
Approximately 10% of humans are left handed	It is a simple statement of fact
Performance on speeded tasks declines in old age	It is another statement of fact
Situations are important in human behaviour	As all behaviour occurs within situations, this assertion is too vague to allow disagreement
Methodological errors prevent firm conclusions from being drawn	This goes without saying
Some human perception is bottom-up	Some perception is top-down too; so what?
IQ tests measure IQ	This is simply a tautology

In the example syllogisms in Table 6.2, there are three pieces of information per line: A numbered code for premise (P) or conclusion (C); the premise or conclusion stated in general form, using letters; and an example of each premise or conclusion.

For a simple example syllogism, imagine my friend and I have some marbles, some of which are on the ground (Syllogism 1.0). Given two premises, a valid conclusion can be made:

Syllogism 1.0		
P1:	All Bs are As	All red (B) marbles are on the ground (A)
P2:	All Xs are Bs	All my (X) marbles are red
C1:	All Xs are As	All my marbles are on the ground

In evaluating syllogisms, I find it helpful to use Venn diagrams. Venn diagrams consist of circles each of which encloses an area denoting a particular part of the syllogism. In our example, we draw the circles on the ground around our marbles. As you shall see below, however, Venn diagrams can be used to enclose far more abstract information than marbles.

To construct a Venn diagram for the syllogism, start with the first part of the first premise: *All Bs*. Draw a circle around all instances of B: red marbles. Now draw a circle for the second part: *are As*. If all Bs are As, then draw a bigger circle around the B circle. This bigger A circle surrounds all the marbles on the ground. The B circle within the A circle encloses marbles that are on the ground and are also red. Then draw a circle completely within the B circle, around those red marbles that are also mine, to represent the second premise: *All Xs are Bs*. Because all of the instances of X lie within the B circle, they clearly also lie within the A circle, so C1 is valid. The complete Venn diagram is given in Figure 6.1.

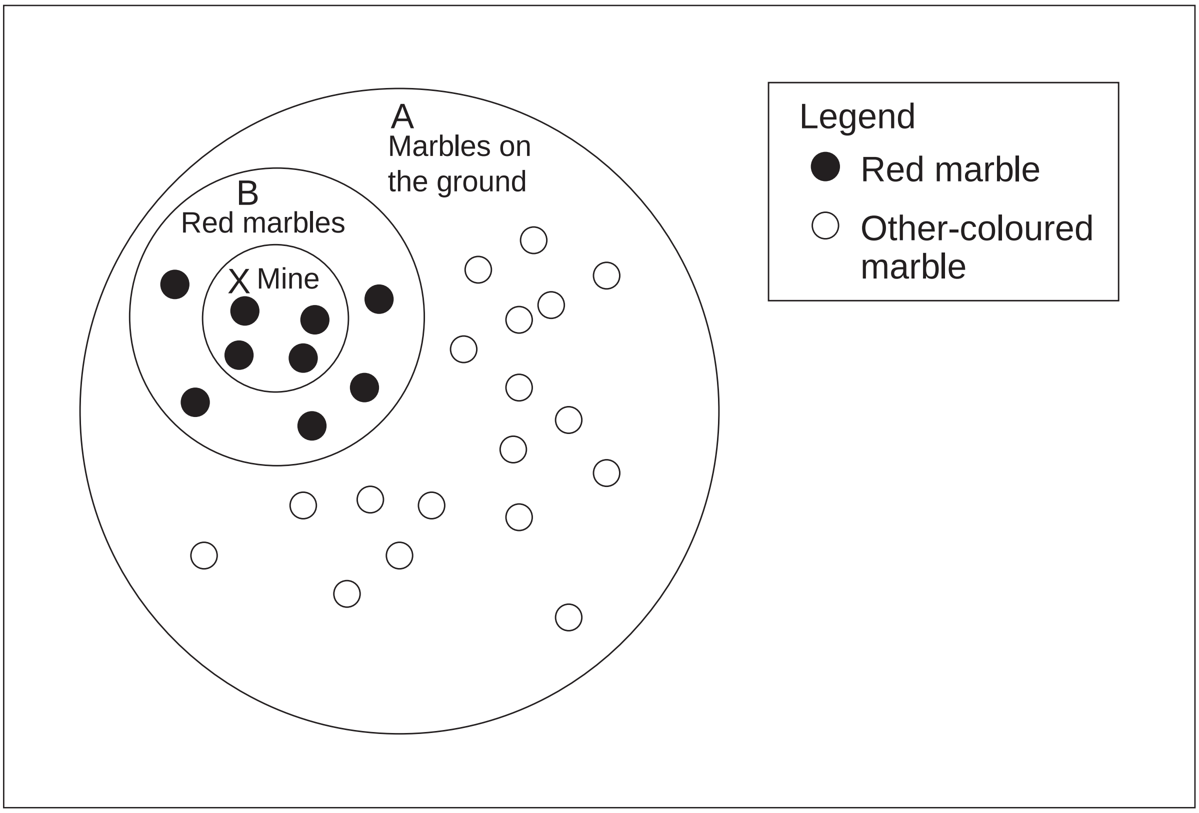

Figure 6.1. A Venn diagram as circles drawn on the ground, enclosing marbles of different colour and ownership. This Venn diagram shows the logic of Syllogism 1.0.

This simple example might seem trivial. It can appear less trivial with another example (Syllogism 1.1) that nevertheless contains the same logical quantities as Syllogism 1.0:

Syllogism 1.1		
P1:	All Bs are As	All learning phenomena show acquisition curves
P2:	All Xs are Bs	Handedness is a learning phenomenon
C1:	All Xs are As	Handedness will show an acquisition curve

The Venn diagram for Syllogism 1.1 is logically identical to Figure 6.1. It is given in Figure 6.2.

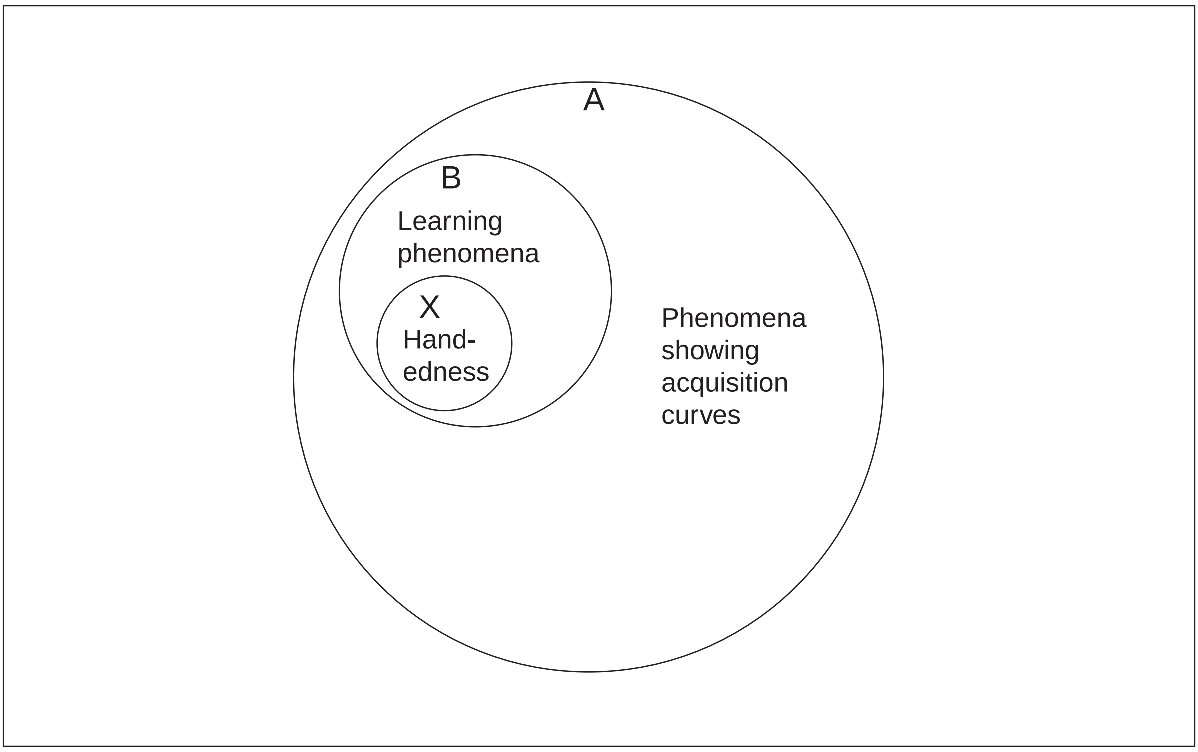

Figure 6.2. A Venn diagram for the logic of Syllogism 1.1.

Venn diagrams allow us to diagnose common logical errors. Assume Syllogism 2.0 is new (i.e., you do not need to consider P2 for evaluating it); test yourself on it:

Syllogism 2.0		
P1:	All Bs are As	All learning phenomena show acquisition curves
P3:	All Xs are As	Handedness shows an acquisition curve
C?:	Are all Xs Bs?	Is handedness a learning phenomenon?

It is impossible to answer the question with certainty from P1 and P3. If you answered "Yes", you made a conclusion that is not justified by its premises. To see why, make a logically equivalent example with marbles on the ground, Syllogism 2.1:

Syllogism 2.1		
P1:	All Bs are As	All red marbles are on the ground
P3:	All Xs are As	All my marbles are on the ground
C?:	Are all Xs Bs?	Are all of my marbles red?

I hope this simple example makes it more obvious that it is impossible to justify answering "Yes" (i.e., All my marbles are red). To check, make a Venn diagram. Start with a large A circle, denoting the marbles on the ground (see Figure 6.3). To complete P1, draw a smaller B circle, completely within the A circle, denoting all of the red marbles on the ground. Note that the circle required for P1 is identical to the same part of Figure 6.1. Now locate the X circle based on P3. P3 states only that X is completely within the A circle. It could be completely within the B circle (X1), partially overlapping the B circle (X2), or completely outside the B circle (X3). We simply cannot say.

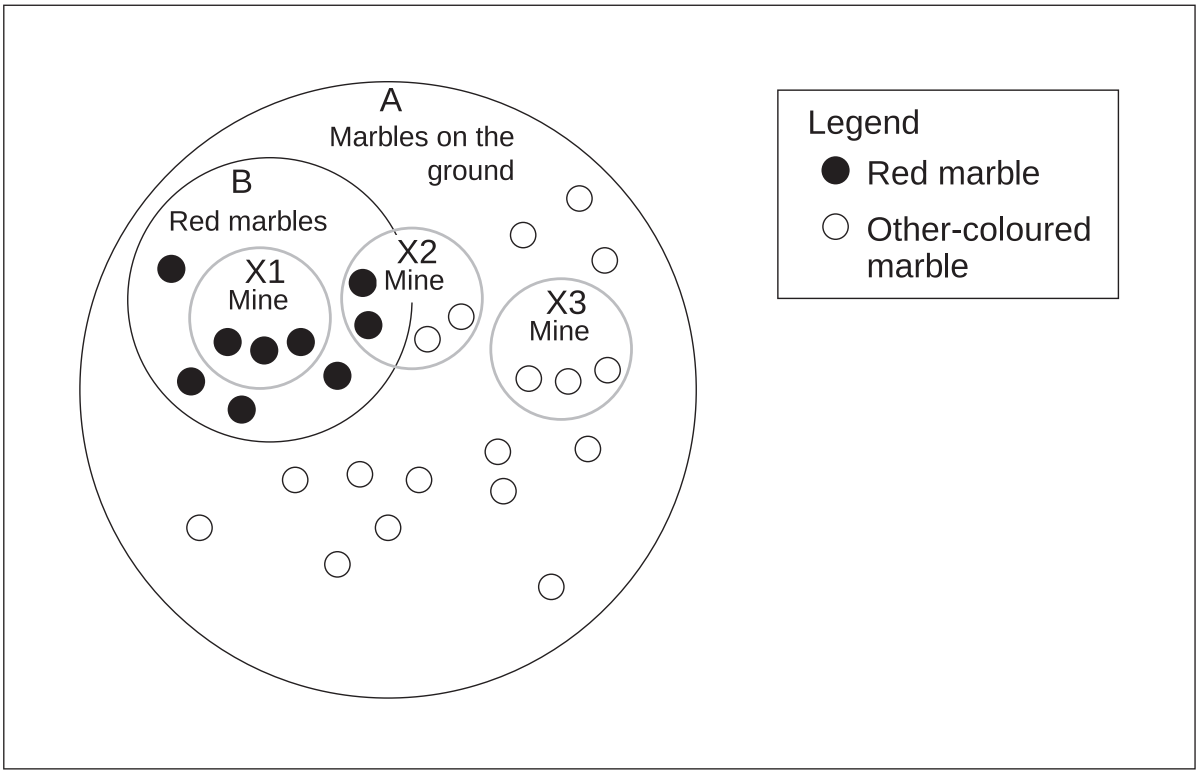

Figure 6.3. Venn diagram for Syllogism 2.1, showing the three possible locations of the X (grey) circle.

Now you should be able to return to Syllogism 2.0 and see that the correct answer is "I don't know". If you cannot, construct the Venn diagram along the lines of Figure 6.3 but for Syllogism 2.0.

It is useful for your reading and writing to know about deductive arguments for at least three reasons. First, you may want to structure your essay in the form of a syllogism. If you do, you will need to be certain your conclusion is valid. Second, you may read a paper that contains a deductive argument. If it is invalid, you will avoid being misled, and will have found a useful thing to discuss in your essay. Published deductions are occasionally incorrect. Third, hypotheses are deductive arguments.