Critical Thinking Exercises

Lesson 1 Skepticism and the Confirmation Bias

When one makes a claim, one is stating that something is a fact. In other words, a claim is a statement that is thought by some people to be true, but that may turn out to be false. In your everyday life, you probably often have heard claims made about mind and behaviour, and you probably think that you already know quite a bit about psychology—the scientific discipline that studies the mind and behaviour. In order to get a sense of what you might know about psychology, please take the following brief test.

Which of the following claims are true?

- dream images are known to have particular meanings, which often involve unconscious desires and conflicts
- eating sugar causes children to become temporarily hyperactive
- most people use only 10% (or less) of their brains
- a person who commits suicide must have been clinically depressed
- there are more admissions to mental hospitals during full moons than at other times
- completely detailed memories of every event we have ever experienced are stored permanently in our minds and can be accessed with hypnosis
- a person who exhibits two or more personalities is diagnosed with schizophrenia
- low self-esteem is known to cause most self-destructive behaviours
• most mental disorders can be cured by remembering and "reliving” distressing experiences from one's past

• waking a sleepwalker is dangerous for him or her

You may be surprised to learn that none of these claims is known to be true. In fact, most are known to be false and a few are, at best, highly controversial. In order to avoid basing our decisions on false claims, we all need to learn to think critically about the claims we hear in our everyday lives. In the science of psychology, researchers think critically about claims made about mind and behaviour. In these lessons, you will learn how to think like a psychological researcher when you hear such claims.

Skepticism and Empiricism

Tara states that she has been abducted many times by extraterrestrial beings. She claims that, on at least one occasion, she was flown to a distant planet. The aliens, she says, have placed devices into her brain that allow them to track her and to monitor her activities at all times. Tara remembers being physically examined by the aliens and operated on a number of times. She believes that they are performing reproductive experiments on humans in order to develop a hybrid species—one that is part-alien and part-human. She has concluded that the aliens are trying to help humans evolve into beings who will have all sorts of strange and wonderful powers.

In Chapter 1 of the textbook, it was stated that scientific psychologists are trained to be skeptical—to doubt a claim unless it is supported by adequate evidence. For example, if someone claimed that she had been abducted by aliens from another planet and flown to a distant planet, most of us would doubt her claim until we had seen good evidence to support it.
Regarding the nature of that evidence, scientific psychologists are trained to be empirical—
to make direct observations relevant to a claim. For example, we might decide to closely
examine physical evidence (perhaps brain implants) that would show, beyond a reasonable
doubt, that her story was true. (In Critical Thinking Lesson 2A, you will begin to learn about the
kinds of observations that scientific psychologists rely on when testing claims.)

In the Critical Thinking Application at the end of Chapter 1, you learned two basic lessons
about critical thinking that are related to skepticism. First, **when an answer to a question is
proposed, a critical thinker always considers other possible answers.** For example, in Tara's
case, we might ask the following question: why does she state that she has been abducted by
extraterrestrials? One possible answer is that she really has been abducted many times by
creatures from another planet. Another possible answer is that Tara is lying, perhaps to gain
attention from others. A third possible answer is that Tara has a mental disorder characterized by
delusional thinking and hallucinations. When you consider a number of alternative answers, you
are more likely to closely examine the evidence in order to see which answer is best supported
by it.

The second lesson you learned in the Critical Thinking Application was that, **when an
answer to a question is proposed, a critical thinker looks to see if there is any evidence that
contradicts the proposed answer.** For example, if CT scans showed no evidence that Tara had
an object implanted anywhere in her brain, or if a visual inspection of her body showed no
evidence of surgical scars, this would contradict her claim that she was, indeed, abducted by
aliens who performed medical procedures on her. This second lesson is actually skepticism in
action: by looking for evidence that contradicts a proposed answer to a question, we try to see if
there is a good reason to doubt the answer. In other words, we are trying to avoid a fundamental error in thinking that is referred to as the "confirmation bias."

The Confirmation Bias

*It was a beautiful Spring day, with clear blue skies and a cool breeze coming off the lake near Rachel's house. She decided that it would be a perfect day to wash her car, which had become very dirty during a recent trip she had taken. After returning from the car wash, she noticed clouds building in the western sky. Within an hour, a dust storm rolled through town, which was followed by a brief thunderstorm. Afterwards, her car looked as if it had never been washed and waxed just a few hours before. Rachel complained to her friend: "Of course it rained. That's because I just washed my car!"

Rachel seems to be saying here that, in some unknown way, washing her car caused a storm to develop that day. In fact, this is a common superstitious belief shared by many people. And it seems to Rachel that this superstitious belief was just confirmed.

Our prior beliefs—our **preconceptions**—cause us to pay attention to particular conjunctions (combinations) of events and to interpret them in particular ways. Because of her superstitious belief, Rachel noticed the conjunction of *washing the car* and *rain*, and interpreted this conjunction in terms of a causal relationship: *washing the car causes it to rain*. She probably never has noticed that there have been many occasions on which she washed her car and it did not rain afterwards; or that, on cloudy days, the sky sometimes has cleared after she has washed her car. Rachel's preconception that *washing the car causes it to rain* has led her to pay attention primarily to those occasions on which the two events occur together and to ignore (or to explain away if she does, in fact, notice) those occasions on which the two events do not occur together.
In general, we have an automatic tendency to pay attention to or seek out information that is in agreement with (confirms) our preconceptions, and to ignore, distort, or avoid information that contradicts (disconfirms) our preconceptions, a tendency that is called the confirmation bias. The confirmation bias serves to maintain and strengthen the beliefs that we already hold by causing us to automatically (that is, without being aware that we are doing so) perceive and remember experiences that confirm these beliefs, and to ignore or reinterpret those that disconfirm them. Because we tend to seek out only confirming evidence, our beliefs over time become so well confirmed in our minds that we come to think of them as "obviously true." In order to avoid the confirmation bias, we must force ourselves to look for evidence that disconfirms our beliefs.

One technique for forcing ourselves to pay attention to disconfirming evidence involves setting up a table that includes both confirming and disconfirming information. To be specific, we count up all the instances in which two events about which we hold a preconception either occur together or do not. In Rachel's case, for example, she might have set up the following table in order to see if the claim, washing the car causes it to rain, was true or false:

<table>
<thead>
<tr>
<th></th>
<th>Washes the car</th>
<th>Does not wash the car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rains</td>
<td>a</td>
<td>c</td>
</tr>
<tr>
<td>Does not rain</td>
<td>b</td>
<td>d</td>
</tr>
</tbody>
</table>

The cell labelled $a$ shows the conjunction of rain and washing her car: these are the days on which Rachel washes her car and it also rains. The cell labelled $b$ shows the conjunction of no rain and washing her car: these are the days on which Rachel washes her car and it does not rain. The cell labelled $c$ shows the conjunction of rain and not washing her car: these are the
days on which Rachel does not wash her car and it rains. The cell labelled $d$ shows the conjunction of no rain and not washing her car: these are the days on which Rachel does not wash her car and it does not rain.

In order to illustrate the use of this table, let's say that Rachel washed her car on 50 different days in a particular year (thus, she did not wash her car on 315 days that year). And let's also say that, during that year, it rained on 73 days (thus, it did not rain on 292 days that year). At the end of the year, the following results were obtained:

<table>
<thead>
<tr>
<th></th>
<th>Washed the car</th>
<th>Did not wash the car</th>
<th>Sums</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did rain</td>
<td>10 (20% of 50)</td>
<td>63 (20% of 315)</td>
<td>73 days of rain</td>
</tr>
<tr>
<td>Did not rain</td>
<td>40 (80% of 50)</td>
<td>252 (80% of 315)</td>
<td>292 days of no rain</td>
</tr>
<tr>
<td>Sums</td>
<td>50 car washes</td>
<td>315 no car washes</td>
<td>365 days</td>
</tr>
</tbody>
</table>

The first cell of the table shows that on 10 of the days on which Rachel washed her car, it also rained. The cell just below that one shows that on 40 of the days on which she washed her car, it did not rain. Putting these two cells together, we see that on 20% $(10/50 \times 100)$ of the days on which Rachel washed her car, it rained; and that on 80% $(40/50 \times 100)$ of the days on which she washed her car, it did not rain. After performing similar computations with the two remaining cells, you will see that it rained on 20% of the days, regardless of whether Rachel had just washed her car or not; and it did not rain on 80% of the days, again regardless of whether Rachel had just washed her car or not. In other words, it was no more likely to rain on days that Rachel washed her car than on days that she had not; and it was no more likely not to rain on
days that Rachel had not washed her car than on days that she had. Washing one's car has no influence on whether or not it will rain.

The confirmation bias is caused by our unconscious tendency to ignore or avoid information that would show that a preconception is wrong. By forcing ourselves to pay attention to all information (by placing the information in tables such as the one above), we are less likely to continue believing claims that are wrong.

CRITICAL THINKING QUESTIONS FOR LESSON 1

Critical thinking refers to a way of thinking about a question or problem, not to the answer or solution that one obtains. Two people may both think critically about a particular question but come up with different answers. This may be because they have weighed information in different ways or considered different types of information when thinking about the question or problem. In the questions below and in the rest of the lessons, "suggested answers" will be provided in order to give you an example of how to think critically about the question being asked. You may often find that your own attempts at thinking critically lead you to choose a different answer as the best one. The fact that you reached a different conclusion does not necessarily mean that you did not think critically. Given the information in the question, your answer also may be a credible one.

Question 1-1

Generate at least two alternative explanations of each of the following sets of observations:

a) Alfred, who is 69 years old and lives alone, is awakened each morning just before 2:00 am by a voice somewhere in his house that says, "I won't take the lift down." The voice
continues saying this for 15 seconds and then stops. Alfred has even tape-recorded the
voice, but no one else who has ever visited his house has heard the voice.

b) Lottery numbers are chosen at random, typically once a week in many states. One week,
the following five winning numbers were drawn in a certain state: 12, 32, 4, 78, and 63.
A week later, the same five numbers were again drawn in this state.

c) Monroe was driving past an intersection at which he had almost been killed in a head-on
collision ten years earlier. Suddenly, he heard his three-year-old son say, "crash, bang,
boom" and then the words, "I'm dead." Monroe was shocked because no one had ever
told his son about his near-fatal car accident.

d) Gordon took a medication that was supposed to help him sleep. Instead, he started to feel
very anxious and could not sleep at all that night.

e) Dee's father had died about two months ago and she was still grieving his death. One
night when she was feeling particularly upset, Dee found herself thinking about the host
of a popular children's television show that she had enjoyed watching when she was
young. She thought to herself, "he must be pretty old by now and, so, he probably will die
soon." She was amazed when she awoke the next morning and, while watching the
television news, found out that this person had indeed died during the night.

Question 1-2

Sequences of numbers may be generated by "rules." For example, we may start with the
following rule: any descending series of three numbers that differ from each other by
one. Examples of sequences that follow this rule are:

- 5, 4, 3
John was asked to examine the following two sequences of numbers:

- 2 4 6
- 18 20 22

He was asked to figure out what rule was used to generate these two sequences, and answered: "the rule is any ascending series of three consecutive even numbers, such as 6, 8, 10, or 100, 102, 104."

John then was asked to test whether or not the rule he chose was actually the rule used to generate the two sequences. The test involved choosing a third sequence of numbers (from the two below), after which he would be told if the sequence he chose actually followed the rule used to generate the two sequences above. If John's goal was to make sure that the rule he formulated was actually the rule used to generate the two sequences of numbers presented above, which of the following sequences should he have chosen as his "test sequence"?

- 7 9 11
- 12 14 16

**Question 1-3**

When we develop a theory, we are developing a set of ideas that help us to explain (in terms of causes) an event or set of events. Read the following description and develop two alternative theories related to it:
Sarah began to drink a large amount of alcohol and to use various drugs about one year before she was diagnosed with schizophrenia—a mental disorder characterized by auditory hallucinations (hearing things, usually voices, that are not really there), bizarre delusions (rigidly held beliefs that could not possibly be true), and illogical thinking.

**Question 1-4**

Let's say that you are asked to look at four cards laid out on a table (Schick and Vaughn, 2002). On one side of each card is a letter and on the other side is a number. You are able to see the following letters and numbers on the cards:

| A | D | 4 | 7 |

You are asked to test the following claim: *if a card has a vowel on one side, it has an even number on the other.* Keeping in mind the discussion above about the need to look for evidence that disconfirms a claim ("a critical thinker looks to see if there is any evidence that contradicts the proposed answer"), which cards would you need to turn over in order to test this claim?

**Question 1-5**

By using a table like the ones described above, design a way of testing the following superstitious belief:

*In order to have a happy marriage, the bride must wear "something old, something new, something borrowed, and something blue."*

**Bibliography and References**


ANSWERS

SUGGESTED ANSWER TO QUESTION 1-1(a)

Alfred, who is 69 years old and lives alone, is awakened each morning just before 2:00 am by a voice somewhere in his house that says, "I won't take the lift down." The voice continues saying this for 15 seconds and then stops. Alfred has even tape-recorded the voice, but no one else who has ever visited him has heard the voice.

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

This story actually is true (see Ezard, 2003). Many people thought that Alfred had tape-recorded the voice of a ghost, but the actual explanation was much more mundane. The following is a quote from a newspaper article about the incident:

_The story reached the website Paranormal News ... There was talk of exorcism. But through it all Mr Mansbridge was obdurate. 'All I want is for it to go away', he said. 'I don't believe in ghosts and I'm certainly not going to ask the local vicar to come around and try to get rid of evil spirits. I'm not going mad. This is a genuine mystery. One thing's for sure, I'm not packing my bags and leaving.'_

_The ghostbusters were local environmental health staff. On a bookcase in Mr. Mansbridge's lounge they discovered a children's Spider-Man watch ... Someone had set the alarm, which plays a catchphrase from the film, by mistake at 1.55 am, left it on the bookcase and forgotten it._
SUGGESTED ANSWER TO QUESTION 1-1(b)

Lottery numbers are chosen at random, typically once a week in many states. One week, the following five winning numbers were drawn in a certain state: 12, 32, 4, 78, and 63. A week later, the same five numbers were again drawn in this state.

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

One possible explanation is that there was some failure of the randomization process, perhaps caused by some fraudulent activity. Another possible explanation is coincidence: we would expect, given the many tens of thousands of times that lottery numbers have been chosen over the years, that eventually the same numbers would be picked twice in a row.

SUGGESTED ANSWER TO QUESTION 1-1(c)

Monroe was driving past an intersection at which he had almost been killed in a head-on collision ten years earlier. Suddenly, he heard his three-year-old son say, "crash, bang, boom" and then the words, "I'm dead." Monroe was shocked because no one had ever told his son about his near-fatal car accident.

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

It is possible that Monroe's son had a psychic experience that caused him to "see" the accident that his father had been in. On the other hand, there are more natural possibilities. It could have been simply a coincidence. For example, it is very likely that the boy has seen car accidents on
television, or perhaps even in real life. He may have been remembering one of these incidents at the same time that they were passing the intersection.

**SUGGESTED ANSWER TO QUESTION 1-1(d)**

*Gordon took a medication that was supposed to help him sleep. Instead, he started to feel very anxious and could not sleep at all that night.*

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

Perhaps Gordon took the wrong pill, either because he picked up the wrong bottle or because someone had placed the wrong pills in the bottle. Another possible explanation has to do with individual differences in the effects of a medication. The effects of a drug depend on many factors that are unique to individuals, including their age, weight, physiological processes, personality, and expectations about the drug's effects (Weiten & Lloyd, 2003, p. 424). It could be one or more of these factors that caused Gordon's unusual reaction.

**SUGGESTED ANSWER TO QUESTION 1-1(e)**

*Nicotine is highly addictive and, when heavy smokers stop for even a short time, they begin to feel strong cravings for the drug. Jason smoked three packs of cigarettes a day for 10 years. Last month, he quit. He has had no desire to smoke since then.*

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

Again, there are individual differences in the effects of drugs. In this case, it could be that Jason did not become physically or psychologically dependent on nicotine because of something
unusual about his physiology (see Chapter 5 for a discussion of drug dependence). Another possibility is that he is getting his nicotine in some other way, such as by chewing tobacco.

**SUGGESTED ANSWER TO QUESTION 1-1(f)**

*Dee's father had died about two months ago and she was still grieving his death. One night when she was feeling particularly upset, Dee found herself thinking about the host of a popular children's television show that she had enjoyed watching when she was young. She thought to herself, "he must be pretty old by now and, so, he probably will die soon." She was amazed when she awoke the next morning and, while watching the television news, found out that this person had indeed died during the night.*

In the following, two possible explanations are mentioned. You may have thought of other possibilities.

It is possible that Dee had a psychic premonition that this person was going to die. Such an ability is referred to as "precognition" (Carroll, 2002) and is defined as the ability to know something before it actually occurs—an ability that cannot be explained by any normal sensory means. On the other hand, it may be that the recent death of her father caused Dee to think about other "father figures" in her life, such as the gentle and kindly host of the television show that she used to watch as a child. Her realization that he was older, as was her father, may have caused her to fear that he, too, would die soon. The fact that he actually did die the night that she thought about him may have been merely a coincidence.

In a later critical-thinking lesson, we will discuss the common occurrence of coincidences in our lives.
SUGGESTED ANSWER TO QUESTION 1-2

Let's say that John chooses the sequence –12, 14, 16– to test whether or not the general rule he has formulated is correct. Given what he already knows about the first two sequences (2, 4, 6, and 18, 20, 22), it is very likely that he will be told that this new sequence also fits the actual general rule. In other words, choosing the sequence –12, 14, 16– will give him no new information. In fact, most people, because of the confirmation bias, will choose this sequence even though it cannot help them to determine if the rule that they have generated is correct or not.

What John needs to do is to try to disconfirm the rule that he has generated. Thus, he should choose the other sequence of numbers: 7, 9, 11. This will give him information, no matter what response he gets. If he is told that this sequence does not fit the general rule, then the rule that he formulated is supported (that is, he should become even more certain that he has figured out the actual rule used to generate the first two sequences). On the other hand, if he is told that the sequence–7, 9, 11–also fits the general rule used to generate the first two sequences, then this tells him that the rule that he formulated–any ascending series of three consecutive even numbers–must be wrong. Other possible general rules for John to look at are:

- any ascending series of three numbers that increase by two (such as 13, 15, 17, and 20, 22, 24)
- any ascending series of three numbers that increase by any amount (such as 1, 5, 22, or 25, 26, 35)

Thus, when faced with a question to answer, we first need to consider several alternative answers. This will help us to avoid the confirmation bias. If we immediately consider only one
possible answer, it becomes more likely that we will unthinkingly look only for evidence that confirms this answer. But, by realizing that there is more than one possible answer, we become better able to look for any evidence that may disconfirm an answer that we are considering.

SUGGESTED ANSWER TO QUESTION 1-3
There are two things we might try to explain here: why Sarah became schizophrenic or why Sarah started using drugs. In fact, you probably concluded that these two events were causally related. Many of you probably developed the following theory: the use of drugs caused Sarah to become schizophrenic. But there is an alternative theory that also is possible: Sarah began having subtle mental problems that were related to her developing schizophrenia (perhaps strange sensations or disturbed thinking) that led her to begin using drugs as a way to self-medicate. While she was using drugs, her schizophrenia developed to the point where it became obvious to others. In this alternative theory, Sarah's drug use was a reaction to her schizophrenia, not a cause of it. There also is a third alternative: Sarah's drug use and her schizophrenia were unrelated. It was merely a coincidence that they both developed around the same time.

SUGGESTED ANSWER TO QUESTION 1-4
We must overcome the confirmation bias in order to test the claim adequately. In other words, we must make sure that we look for evidence that would show the claim to be wrong, in addition to evidence that would show it to be correct. The confirmation bias leads many people to focus on only the "A" and "4" cards: these are the cards with a vowel and an even number, which make up the claim being tested.
The "A" card is important: if we turned it over and found that it had an odd number on the other side, this would disconfirm the claim. If there were an even number on the other side, this would confirm the claim.

The "4" card is of little help, however. Although it is true that it would help to confirm the claim if there were a vowel on the other side, if there were a consonant on the other side, the claim still could be true. This is because the claim does NOT say, *if a card has an even number on one side, it has a vowel on the other.*

The card that the confirmation bias typically leads people to ignore incorrectly is the "7" card. If we turned it over and found a vowel on the other side, this would disconfirm the claim. Thus, it is an important card to turn over. (A consonant on the other side wouldn't help, however.)

The "D" card cannot help at all. It would not matter what was on the other side because the claim involves vowel cards.

Thus, the confirmation bias causes people to focus on the "A" and "4" cards: we tend to look for evidence that confirms a claim. But this analysis shows that the "7" card is as important as the "A" card (both can disconfirm the claim); and that the "4" card is not very important.

**SUGGESTED ANSWER TO QUESTION 1-5**

One way to test this superstition is to divide married couples into two groups; those in which the bride wore "something old, something new, something borrowed, and something blue" on their wedding day, and those in which the bride was missing one or more of these items. We then could wait a period of time, perhaps 10 years after the wedding day, and determine which couples had divorced during that time. Of course, you might argue that some couples who are unhappy in their marriage may not have obtained a divorce (at least, not yet); but we would
expect that whether or not a couple has divorced and whether or not a couple is happy would be closely associated.

We then would put the results into the following table:

<table>
<thead>
<tr>
<th></th>
<th>Divorced</th>
<th>Not divorced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wore the 4 items during wedding</strong></td>
<td>a</td>
<td>c</td>
</tr>
<tr>
<td><strong>Did not wear the 4 items during wedding</strong></td>
<td>b</td>
<td>d</td>
</tr>
</tbody>
</table>

If the superstition is correct, there should be a larger proportion of couples in cell $b$ (brides who did not wear the four items should be divorced more often) and in cell $c$ (brides who did wear the four items should be "not divorced" more often) when compared to cells $a$ and $d$. If, on the other hand, the superstition is incorrect, the proportion of couples in cells $b$ and $c$ should be equal to those in cells $a$ and $d$.

Of course, if we found that the superstition is correct, we then would want to figure out why this is so. That is, we would want to develop a theory that would explain why brides who wear the four items are more likely to have a successful marriage than brides who don't. One explanation might be that, when a bride takes care right from the start of her marriage to make it a happy one (by taking care to wear the four items), this means that she is very motivated to make the marriage work and, thus, that she is more likely to work hard to get through the difficulties that face most married couples. In other words, in this theory, it is not the four items that are causing a happy marriage, it is the wife's attitude towards the marriage.

Of course, there are other possible theories we would need to examine if the superstition were found to be true. We would need to think of a number of possibilities and then make direct
observations that would help us to determine which theory was most likely to be the correct one.

In future critical-thinking lessons, we will work more on learning how to do this.