

**TRUE
OR
FALSE?**

The cloud contains several icons: a lightbulb in a purple speech bubble at the top left, a large stylized eye at the top center, a computer monitor with vertical color bars at the top right, a question mark in a white thought bubble on the left, an exclamation mark in an orange speech bubble on the right, a smartphone with a globe icon at the bottom left, and a newspaper with a star and the word 'NEWS' at the bottom right. There are also several small light blue circles floating around the cloud.

**The Science of Perception,
Misinformation, and
Disinformation**

Jacqueline B. Toner, PhD



TRUE OR FALSE?

The Science of Perception,
Misinformation, and
Disinformation

Jacqueline B. Toner, PhD

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DEDICATION

This book was written with my darlings in mind. For Henry, Julian, Lilly, and Margo—JT

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**A Note for
the Adults
in Your Life**

The importance of fostering critical thinking is often emphasized when speaking of the educational needs of children in middle and high school. Definitions of critical thinking vary but most focus on a number of different cognitive skills, including the ability to analyze information and think rationally about it. Whatever the definition, the goal is to help students develop a questioning approach to information so that they can arrive at an unbiased judgement about its accuracy.

Not an easy task! I have shared some of what psychologists have learned about how we are fooled into believing things that simply aren't true. Our own cognitive processes, attention, and emotions sometimes interfere with perception and clear thinking. Prior knowledge can distort our understanding of new information. And then, there is the problem of misinformation and disinformation.

How do we protect kids (and ourselves) from making poor judgements about what is accurate and what is not? As is discussed towards the end of the book, research has shown that the most effective protection against disinformation is "prebunking," a warning that false information is coming, who is presenting it, and why.

Of course, we can't anticipate all the false messages our children (or we) will encounter, and prebunking is not always an option. I think of this book as what I will call "procedural prebunking," or presenting facts (as well as they are currently understood) about the ways in which we humans come to misunderstand things. My hope is that by drawing back the curtain and shedding light on the process of misunderstanding, kids can become more effective critical thinkers.

Good luck!
Jacqueline B. Toner, PhD

INTRODUCTION

**When the World
Was Flat**



Quiz Time!

Have a look at the following statements. Which do you think are true and which are false?



- Tomatoes are poisonous.
- People only use ten percent of their brains.
- A ten-year-old Twinkie is still fresh enough to eat.
- Cold weather means that global warming is fake.
- Reading in the dark ruins your eyes.
- Bulls get angry when they see red.
- Bats are blind.
- Dogs sweat with their tongues.
- Swimming after eating causes cramps.
- Lightning never strikes the same place twice.
- Earth is flat.



Turns out they are all false. If you believed some of them, that's okay. You are not alone! Lots of people are fooled when wrong information is passed from person to person. Sometimes that wrong information fools a lot of people, even most people, for a long time. Even years and years!

You may have heard that, until Columbus set out on his exploration, people believed the Earth was flat. Not so much. The ancient Greek philosopher, Aristotle, not only believed Earth was a sphere, but shared his evidence more than 2,000 years ago! While some people may have continued to think the Earth was flat, most educated people did not. Christopher Columbus certainly knew the planet was round before he set out on his explorations. Yet, for generations, children have been led to believe (by adults who believe it) that people during Columbus's time were sure he would sail off the edge of the flat Earth.

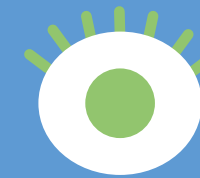
That's not the only thing people believe because "everyone knows it's true." At one time or another you've probably been told by an adult to put on a coat so you won't catch a cold. But cold weather doesn't cause colds, viruses do. Although people tend to get more colds during winter, it has nothing to do with the weather. It happens because, when it is cold, people spend more time inside close to other people (and their germs).

Both misunderstandings (as well as many more) have been shared, believed, and passed on by lots of people. How does such a thing happen? As you'll learn more about later, hearing the same (wrong) idea over and over can make it seem true. It can also make it seem that everyone believes it.

In the pages of this book, you will read about how false beliefs come about and why they tend to stick. You will also discover how misunderstanding, and misuse of scientific findings can lead people to the wrong conclusions and cause lots of problems. Once you know all this, you will be less likely to be fooled by things you hear, read, and see that aren't true. Dig in and learn how to separate fact from fake!



PART ONE



Imperfect Minds:

The Science of Perception and Misunderstanding



You are an amazing thinker. Our world is filled with sights, sounds, and other sensations, but you can focus on what matters most. You recognize patterns and relationships quickly and easily. You make comparisons to things you already know, often without even realizing it. You simplify new information and tie it to older stuff you already know, which helps you remember it and recall it later.

But this efficiency comes with some built-in glitches. Our quick and automatic thinking can put us at risk of making errors. Those mistakes can even fool us into believing things that aren't true.

In Part One, we will explore what psychologists have uncovered about our thinking strategies. We'll look at how those skills can lead to distorted beliefs. Learning what we, as humans, tend to overlook or cast aside can help us make fewer mistakes about what we really "know."



CHAPTER 1

Can You Believe It?



Your science teacher just gave you an assignment to find out how the brain understands what a person sees and hears. You head to the library and search for information in the biology and psychology sections. After browsing through books for an hour, a friend walks in and says, "What is the color of the book second from the right on the top shelf of the room you just left?"

You give them a weird look, then shrug. "It's red," they say. And you believe them, but you wonder. You certainly saw that book, so why don't you know the answer?

There is a lot going on in this situation, so let's start from the beginning, with your senses.



When someone says something that doesn't match your experience, you might protest, "But I saw it with my own eyes!" It makes sense to think you can believe things you've personally seen or heard. But what you experienced isn't the whole story. The information that comes through your senses is just the first step. Next, your brain has to interpret that information. That's called perception. It happens super quickly and most of the time your brain does a pretty good job. But sometimes, its fast speed and built-in shortcuts can cause errors. In fact, human brains can be a little glitchy, as you'll read about in this chapter. Seriously, your brain isn't a computer. It can make processing errors! Let's take a closer look, starting with your **senses**.

— See It, Hear It, Feel It, Know It?

We all know our senses never lie, right? Well, sort of. While our senses don't lie, our brain can misinterpret what we see, hear, or feel, and fill in gaps to get to something more familiar, safe, or comfortable.

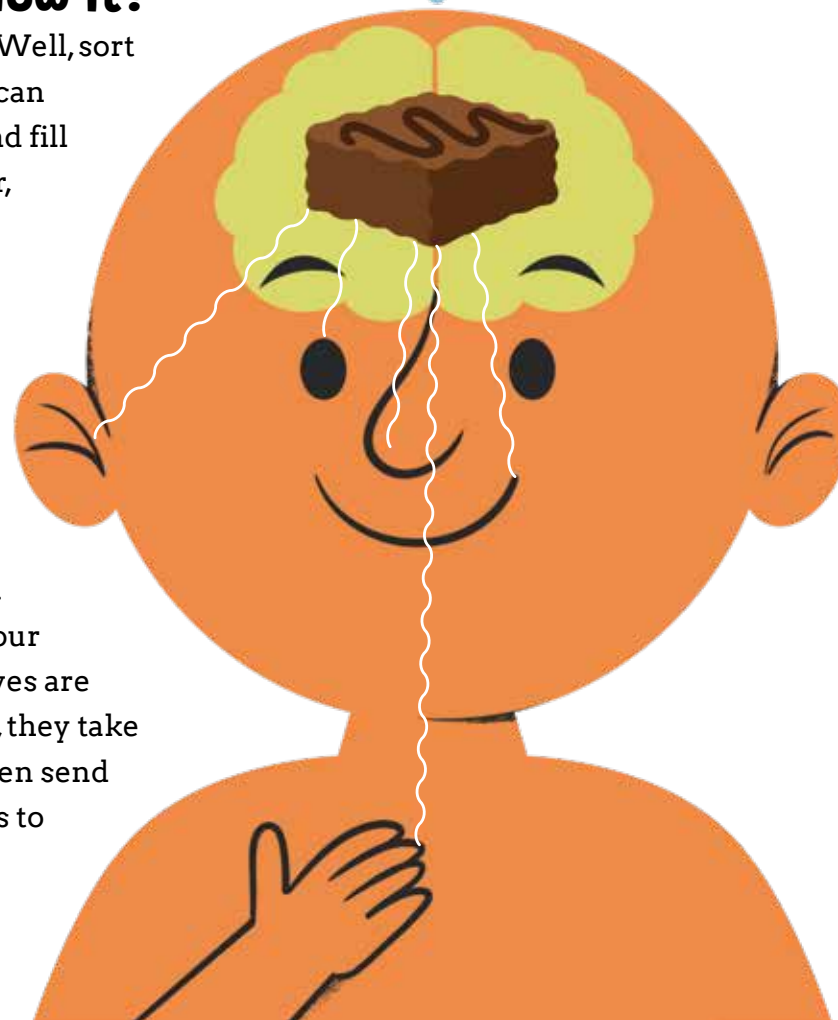
Look at this drawing.

Is it a circle? Most people would say it is. But look again. A circle is a continuous curved line, but this drawing shows three curved lines that aren't connected to each other.

Although we talk about "seeing" with our eyes, the process is more complicated. Eyes are **sensory organs**. Like all sensory organs, they take in information from the environment, then send signals to your brain. Next, your brain has to make sense of what you experienced.

Senses/Sensory organs: our five senses are sight, hearing, touch, taste, and smell. Information is collected through sensory organs (eyes, ears, skin and pressure sensors, taste buds, and nose) and sent to the brain for interpretation.

Slam! I **hear** the oven door close. I **see** something brown. It **feels** warm. It **smells** yummy. It **tastes** sweet. It's a brownie!



— Pay Attention!

Maybe you've had a teacher or a parent remind you to

Pay Attention!

Of course, when that happens the person asking you to pay attention wants you to pay attention to something specific, like a classmate during their book report or your dad explaining board game rules during family game night.

But it's impossible to pay attention to everything around you all the time. You pay close attention to some things and ignore others. You need to be able to ignore some things or you would be overwhelmed—your brain can't possibly record everything it sees! You might be surprised by what your brain "sees" and doesn't see.

— CHECK OUT THE RESEARCH —

In a very famous experiment, Daniel Simons and Christopher Chabris showed just how extreme errors can be when we aren't paying 100% attention. They asked students to watch a video of people passing a basketball and to count the number of passes between people wearing white shirts. Only half of the people watching the video noticed when a person in a gorilla suit walked through the group, beating their chest. Dr. Simon and Dr. Chabris labeled this phenomenon **inattention blindness or selective attention**. Search online for "Gorillas in Our Midst," to see the actual video used in the experiment. Hard to believe, but it is true!

Try This

Don't turn the page. Remember the drawing of the library in the beginning of this chapter? How many kids were there? Were they sitting at a table or on the floor? Did the librarian have her hair in a ponytail? What animal was on the front of one kid's t-shirt? Was there a blue book on the second shelf?

If you are unsure of any of these details, it isn't because your eyes failed to see them. It's because they didn't seem important, so you didn't pay attention to them.

Inattention blindness: the failure to see something that is clearly visible because attention is focused on another activity or object.