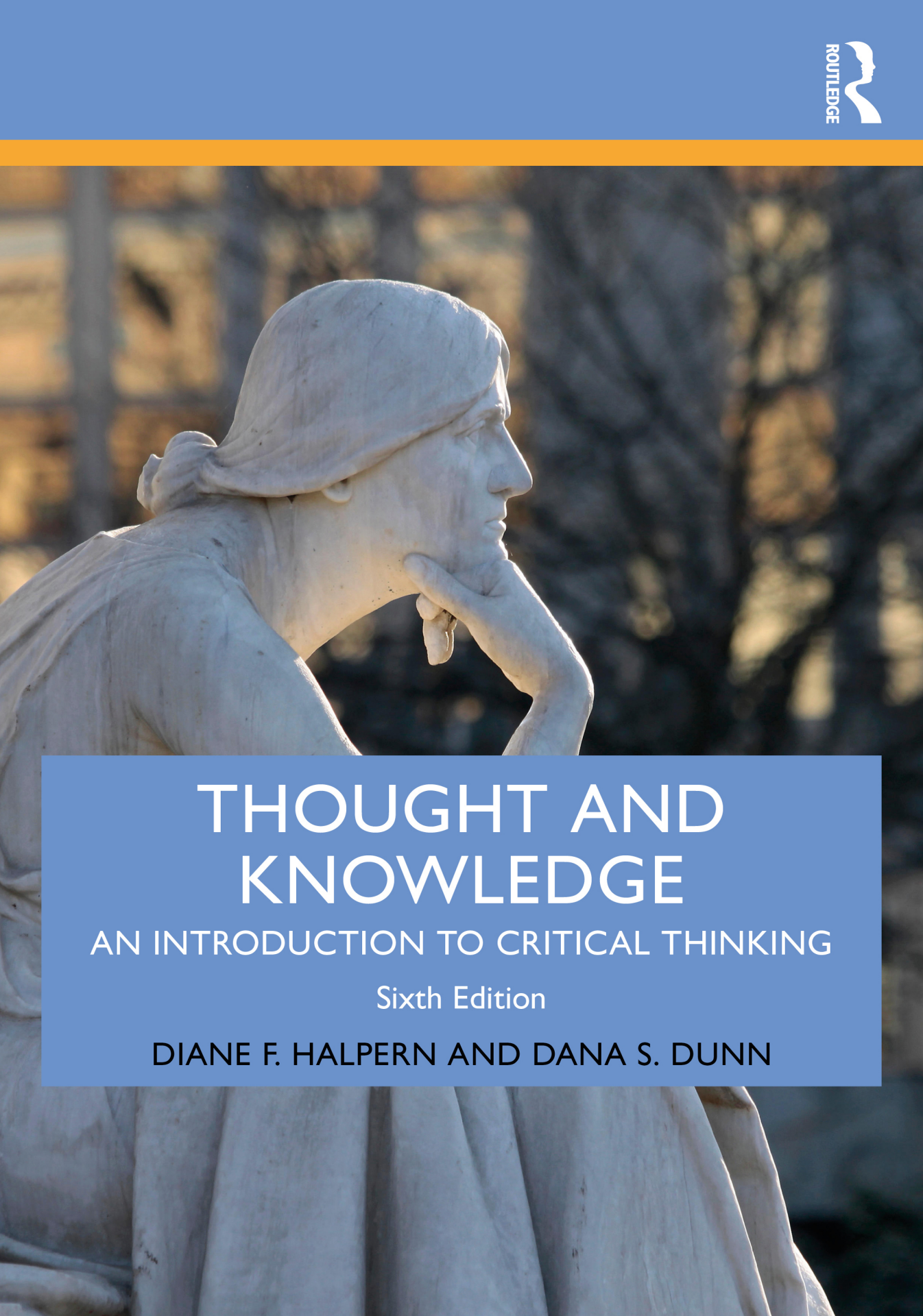

THOUGHT AND KNOWLEDGE

AN INTRODUCTION TO CRITICAL THINKING

Sixth Edition

DIANE F. HALPERN AND DANA S. DUNN

"*Thought and Knowledge* is a superb introduction to logic, reasoning errors and analysis of evidence. The authors are the world's most distinguished experts studying how we think and how we can think more effectively."

Richard E. Nisbett, Professor of Psychology Emeritus, University of Michigan

"In the age of social media, all of us are victims of information warfare, and ordinary manipulation. For our own sanity and happiness, we must learn how our minds work and how they are hacked. *Thought and Knowledge* is a superb introduction to cognitive psychology with engaging writing about the world as it is today. The authors use psychology to teach psychology. This book will help you succeed in a complex informational landscape, and it will help all who read it to become better cognitive citizens."

Jonathan Haidt, Thomas Cooley Professor of Ethical Leadership, New York University—Stern School of Business, author of *The Righteous Mind*, co-author of *The Coddling of the American Mind*

"This is a book for our times. It drills deeply into the nature and application of critical thinking and provides compelling illustrations and explanations of its various facets. If you want to think critically about critical thinking, this book is for you."

Stephen M. Kosslyn, Founding Dean and Chief Academic Officer of the Minerva Schools at KGI and John Lindsley Professor of Psychology in Memory of William James, Emeritus, Harvard University

"Halpern and Dunn have created a fascinating, scholarly (but accessible), and eminently useful book that not only introduces students to some of the best research on critical thinking, but does so in a delightful, engaging manner. This volume is full of attention-capturing exercises that students will resonate with and learn from. By the end of the book, students will have been exposed to the best of cognitive science, communicated by an extraordinarily talented team with the gravitas to definitively own and teach this topic."

Wendy M. Williams, Professor and Director of the Cornell Institute for Women in Science, Department of Psychology, Cornell University

Thought and Knowledge

Thought and Knowledge applies theory and research from the learning sciences to teach students the critical thinking skills that they need to succeed in today's world. The text identifies, defines, discusses, and deconstructs contemporary challenges to critical thinking, from fake news, alternative facts, and deep fakes, to misinformation, disinformation, post-truth, and more. It guides students through the explosion of content on the internet and social media and enables them to become careful and critical evaluators as well as consumers.

The text is grounded in psychological science, especially the cognitive sciences, and brought to life through humorous and engaging language and numerous practical and real-world examples and anecdotes. This edition has been streamlined with thoughtful consideration over what content to keep, what to cut, and how much new and current research to add. Critical thinking skills are presented in every chapter, empowering students to learn more efficiently, research more productively, and present logical, critical, and informed arguments. The skills are reviewed at the end of the chapter, and a complete list of skills with definitions and examples are included in the appendix. The text is supported by a companion website that features a robust set of instructor and student resources: www.routledge.com/cw/halpern.

Thought and Knowledge can be used as a core text in critical thinking courses offered in departments of psychology, philosophy, English, or across the humanities and social sciences, or as a supplement in any course where critical thinking is emphasized.

Diane F. Halpern, PhD is Professor of Psychology Emerita at Claremont McKenna College and Past-President of the American Psychological Association (APA), the Western Psychological Association, APA Division 1 (Society for General Psychology), and APA Division 2 (Society for the Teaching of Psychology).

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An Introduction to Critical Thinking

Sixth Edition

Diane F. Halpern
Dana S. Dunn

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Dedication

We dedicate this book to the next generation of thinkers and leaders. These include Amanda Halpern, Jason Halpern, Belle Halpern-Duncan, Hannah Dunn, Stefana Dunn, Annaliese Dunn, and Jake Dunn.

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Preface to the Sixth Edition

THE CRISIS IN CRITICAL THINKING

All of the previous editions of *Thought and Knowledge* began with why we need instruction in critical thinking. But this time seems different. We are experiencing a global crisis in critical thinking where the number of ways to mislead citizens is multiplying every day. A new vocabulary has emerged from the crisis in critical thinking—alternative facts, fake news, deep fakes, armies of bots, misinformation, disinformation, post-truth. Increasingly, people are getting their news and their views from like-minded people on social media platforms. Don't believe the US ever landed on the moon? We've got a group for you. Don't believe the news stories in newspapers who employ journalists who pledge ethical reporting? No problem? A social media post can be found that will contradict what you read. Wondering whom to vote for in upcoming elections? Numerous interest groups, some sponsored by governments in other countries with interests that are very different from those in your country, are happy to help you decide. Science? You don't see why we need it? You can find plenty of anti-science supporters. Even some "basics," such as the idea that the earth is round (actually spherical) is countered by noisy groups. "Armies" of bots (short for robots) flood social media with messages that are either for or against various policies and politics. How can anyone know what to believe and what to do?

These are serious problems. Of course, there have always been deliberate attempts to mislead people with half-truths, lies, and innuendos, but now they are almost impossible to avoid. Various snake oil formulas have been touted as cures for every imaginable illness (indeed, in the recent pandemic, a number of doubtful, if not dangerous, "cures" for Covid-19 were floated on social media and even in the news). One problem is that it has become increasingly difficult to separate the phony spiels from the honest reports. In addition, there are human tendencies to believe what we want to be true, a preference for anecdotes over scientific findings, and plain old mental laziness—not caring enough to do the hard work of critical thinking. We address these issues and many more in this edition of *Thought and Knowledge: An Introduction to Critical Thinking*. Please take your time to work your way through the various chapters. Learn the skills and attitudes as though your future and the future of the planet depend on it. Because they do.

Introducing Dana S. Dunn

Readers of the five previous editions know that they were all single-authored by Diane F. Halpern. But now, I am excited to introduce my new co-author, Dana S. Dunn. If you have been active in the large community in the scholarship of teaching and learning or the smaller

community of professionals who work with people with disabilities, you already know Dana's work. For the rest of you, let me introduce him: Dana is a professor at Moravian University, a small liberal arts institution in Bethlehem, Pennsylvania. He is the author or editor of several books that deal with teaching and learning issues—and the importance of critical thinking in promoting these essential aspects of education. He is thrilled to join me as a co-author of *Thought and Knowledge* and, like me, sincerely hopes our work can help you to improve your critical thinking skills as you tackle the challenges found in the classroom, your career, and in your everyday life.

We are grateful for the support and timely advice from Georgette Enrique and Lucy Kennedy, our editors at Taylor & Francis. They have been responsive and helpful at every step of the writing process. We sincerely thank the incredible reviewers who commented on earlier versions of this book. Some reviewers wish to remain anonymous, so we thank them anonymously. We sincerely appreciate your guidance. We would like to say that any errors in this book should be blamed on the reviewers, but we would never get away with it. If you find errors or you just want to say hello and tell us how you liked this book, please feel free to contact us: DianeFHalpern@gmail.com and Dunn@Moravian.edu

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Sincere thanks to all of you and to the incredible reviewers on earlier editions of our book. Your guidance has improved our book, and we are very grateful.

CHAPTER 1

Critical Thinking

An Introduction

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Both of Diane's (first author) grandmothers came from "the old country"—one from Poland and the other from Romania. She recalls stories from her childhood about their dislike for each other, which was always kept as an unspoken but open secret because despite their mutual dislike, her maternal grandmother had a skill that was needed by her paternal grandmother. Because of this need, they had to at least feign liking for each other. Her maternal grandmother practiced the ancient art of cupping. Many people, including her grandmothers, believe that cupping cures a variety of illnesses. Her maternal grandmother would light a match inside a small cup, then after burning off the oxygen in the cup, she would put out the match and place the hot cup on the back of the person seeking the cure. The cup would create a suction so that when it was removed circles of red welts would appear on the skin where the cup was placed. The theory behind this treatment was that when the cup was pulled off the body, it would suck out the illness. Did some people who sought this cure feel better afterwards? Anecdotal evidence suggests that they did, but were improvements caused by the sucking action of the cups or the belief that it would work? What would you say to "believers" like Diane's grandmothers? More importantly, why should we care if at least some people felt better after this treatment? These are all central questions for our discussion of critical thinking.

THE NEED FOR CRITICAL THINKING SKILLS

False News! Alternative Facts! Conspiracy Theories! Post Truth! Anti-knowledge! Misinformation!

This is a short list of terms that have entered our everyday language in the last few years. Although each of these terms has a different connotation, they all involve attempts to deceive or misinform readers. How can we know "real news" from "fake news" and how can we guard

against the numerous and often creative ways that others attempt to change what we think and what we believe to be true?

Of course, there is nothing new about fake news or the other terms used to describe the tsunami of attempts to get us to believe something or to act in a certain way that is not supported by the evidence or by the use of appropriate reasoning skills. The list of topics targeted by these attempts is not random—often they are tied to a particular political ideology or an attempt to get us to buy something. What has changed is the use of the internet, where most of us get our information and where it is easy for anyone to post anything. Not that long ago (okay maybe it was long in terms of the way information is generated), most people got their information from trusted sources—a wise-looking announcer on a major television network news show or a local or national newspaper with articles written by journalists who adhered to ethical standards such as fact-checking. Because there are many attempts to change how we think and act with false information, this topic is addressed in several chapters in this book, so stay tuned. If you are not sure what constitutes fake news, you will be before you finish this book.

But first, before we address these hot topics, let's begin with some basic definitions of what it means to think critically and then see how we can use this knowledge to defend against and debunk the many forces that attempt to hijack our thinking.

The International rise in the use of the internet changes (almost) everything.

> If one were able to store 175ZB onto BluRay discs, then you'd have a stack of discs that can get you to the moon 23 times.
>
> (David Reinsel, quoted in Patrizio, 2018, para. 4)

Any attempt to comprehend the size of the internet and number of users is doomed to failure because the numbers are mind-boggling and the units used for measurement are not even meaningful to non-techies—exabytes, quintillion bytes, petabytes, Zettabytes, and yottabytes. Estimates of the population of the entire world are around 7.7 billion people (Worldmeters, n.d.). More than half (57%) of the people on earth today are active internet users, with North American and Northern Europe at 95% and many smaller countries at 99% (e.g., Iceland, Norway, Aruba; Clement, 2019b). We cannot imagine a world without the internet. Many billions of people use various social media apps including ones that allow users to generate information for others to see, such as Facebook, YouTube, Instagram, and others (Clement, 2019a).

The internet is an integral part of most people's lives with its wealth of information that exceeds anything we could have imagined even two decades ago. We cannot think of any topic that is so obscure that it cannot be found with just a few keystrokes from a nearby keyboard. The internet has democratized knowledge. The "important stuff" is no longer kept in dusty library stacks that are available only to a privileged few. Massive quantities of information are available to anyone with a computer (or various other devices) and internet access—which is almost everyone except those in the most remote regions of the world. But, the widespread availability of information has a downside. A racist–hate website may look like a reliable news source; bogus health information is sold as though it really was "doctor-recommended," and information about international conflicts can provide one-sided accounts that appear to be

fair and unbiased. How can any of us know what to believe, and how can we use the massive amounts of information to make informed decisions?

The Twin Pillars of Knowing and Thinking

If we cannot think intelligently about the myriad of issues that confront us, then we are in danger of having all of the answers, but still not knowing what they mean. The twin abilities of knowing how to learn and knowing how to think clearly about the rapidly proliferating information that we must select from are the most important intellectual skills for the 21st century.

Is there evidence that we need to learn how to think critically? Lots of it. Consider for example, the Flat Earth Society, dedicated to the proposition that well, you can guess the rest. In fact, belief in the idea that the earth is flat is growing (The Data Team, 2017). You may be thinking, what about photos of the earth taken from space? Flat earthers believe that those photos are fake. Every time the Rapper B.o.B. tweets his theory of a flat earth the number of believers increases. Columbus could not have sailed the "ocean blue in 1492" without the knowledge that the earth is roughly spherical. This is not "new news." In 350 B.C.E. Aristotle announced that "The shape of the heaven is of necessity spherical, for that is the shape most appropriate to its substance and also by nature primary" (translated by Stocks, n.d., Book II Part 4, line 1). Did the Flat Earthers miss the news? We don't know about you, but we have never heard of anyone falling off the edge of the earth.

Mindless voters are a threat to democracy. Voters need to know how to think about complex issues such as politics, AIDS, and climate change, just to name a few. Every year millions of dollars are spent on phony cures for illnesses that may have responded to conventional treatments. If you are looking for a long and bizarre list of the harm caused by faulty beliefs, take a look at What's the Harm (n.d.)? It is a website that documents "the harm that comes from not thinking critically" (http://whatstheharm.net/whatisthis.html).

The depressing list of findings and reports supports the conclusion that many adults do not have adequate thinking and learning skills. It is difficult to imagine any area where the ability to think clearly is not needed. Yet, few of us have ever received explicit instructions in how to improve the way we think. Traditionally, our schools have required students to learn, remember, make decisions, analyze arguments, and solve problems without ever teaching them how. There has been a tacit assumption that adult students already know "how to think." Research has shown, however, that this assumption is wrong. The situation is succinctly summed up by Brock, formerly the Republican Party chairman and currently an international consultant, who, after reading a recent report on the low level of learning and thinking skills of college graduates, exclaimed, "It ought to terrify everybody" (quoted in Frammolino, 1993, p. A41).

What We Really Need to Know

> 100% percent of employers deem critical thinking/problem solving as very to extremely essential in new hires.
>
> (National Association for Career Development and Talent Acquisition, 2019, para. 3)

What we need to know and be able to do as informed citizens has been changing at an increasingly rapid rate. The workforce is one critical place where we can witness the dizzying pace of change. There is an increased demand for a new type of worker—the "knowledge worker" or the "symbol analyst," a phrase that is used by the United States secretary of labor to describe someone who can carry out multi-step operations, manipulate abstract and complex symbols and ideas, acquire new information efficiently, and remain flexible enough to recognize the need for continuing change and for new paradigms for life-long learning. Workers in almost every job category can expect to face novel problems in a workplace that is changing repeatedly. Familiar responses no longer work, and even newly acquired ones will not work for long.

Employers know what they want from their employees and what colleges should be teaching their future employees (Hart Research Associates for the Association of American Colleges & Universities, 2018). In a survey of 501 business executives and 500 hiring managers, their top choice is to teach students to communicate effectively both orally and in writing, followed by "critical thinking and analytical reasoning skills." We would add here that no one can communicate clearly if their thinking is muddy, so these two top concerns are inextricably related. In fact, four of the top five learning outcomes that employers want for their employees are subsumed under the general heading of critical thinking—applying knowledge in real-world settings, analyzing and solving problems, connecting choices to actions, and being able to innovate and be creative. Politicians of every persuasion, blue ribbon panels, workers, and students all recognize the critical importance of critical thinking as the primary objective of education.

Consider this: Most people will finish their formal education between the ages of 18 and 22. Today's young adults are expected to have the longest average life span in the history of the world, with most living into their 70s and many living into their 80s and 90s. We can only guess what life will be like in the years 2075 or 2085 or beyond, years that many of you who are reading this book will live through. One likely guess is that many of today's young adults will be working at jobs that currently don't exist and dealing with technologies that dwarf the imagination of present-day science fiction writers. What do they need to learn during their first two decades of life that will prepare them for their remaining 60+ years?

Thought and Knowledge

> Knowledge will forever govern ignorance: And people who mean to be their own Governours, must arm themselves with the power which knowledge gives.
>
> (James Madison, Texas Library Association
> www.txla.org/groups/godort/kip-award.html)

One of the elementary schools that Diane (first author) attended as a child had the words "Knowledge is Power" chiseled into a concrete block above its front door. If we were asked to amend this maxim based on our experiences over the many years since Diane last passed through those doors, we would edit the concrete block to read, "Thought and Knowledge are Power"

because knowledge is powerful only when it is applied appropriately, and thought is powerful only when it can utilize a large and accurate base of knowledge.

This is a book about thought and knowledge and the relationship between these two constructs. It is about thinking in ways that allow us to use previous knowledge to create new knowledge. Everything we know, and everything everyone else knows—that is, all existing knowledge—was created by someone. When we learn Euclidean geometry, we are learning about knowledge created by the great mathematician, Euclid. Knowledge is not something static that gets transferred from one person to another like pouring water from one glass to another. It is dynamic. Information becomes knowledge when we make our own meaning out of it. We build on the knowledge created by others to create new knowledge.

We also create knowledge every time we learn a new concept. The newly acquired information is used to construct our own internal knowledge structures. ("Knowledge structures" is a technical term used by cognitive psychologists to describe all of the interrelated concepts that each of us have about different subjects.) We use our existing knowledge when we receive new information in order to make sense of the new information, thus the acquisition of knowledge is an active mental process.

A Working Definition of Critical Thinking

> Ultimately, it is not we who define thinking, it is thinking that defines us.
>
> (Carey, Foltz & Allan, *Newsweek*, February 7, 1983)

Take a few minutes and think about your own definition of critical thinking. What would it include and what would it not include?

Although many psychologists and others have proposed definitions for the term "critical thinking," these definitions tend to be similar with considerable overlap among the definitions. In a review of the critical thinking literature, Fischer and Spiker (2000) found that most definitions for the term "critical thinking" include reasoning/logic, judgment, metacognition, reflection, questioning, and mental processes. Jones and his colleagues (Jones et al., 1995) obtained consensus from among 500 policy makers, employers, and educators, who agree that critical thinking is a broad term that describes reasoning in an open-ended manner and with an unlimited number of solutions. It involves constructing a situation and supporting the reasoning that went into a conclusion.

We can think of critical thinking as good thinking, but that definition leaves us with the problem of recognizing what good thinking is and differentiating good thinking from poor thinking. Here is a simple definition that captures the main concepts: *Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task*. Critical thinking is more than merely thinking about your own thinking or making judgments and solving problems—it is effortful and consciously controlled. Critical thinking uses evidence and reasons and strives to overcome biases.

One of our favorite definitions of critical thinking was published over 60 years ago (1960) and comes very close to a contemporary notion of critical thinking: "Critical thinking then is the process of evaluation or categorization in terms of some previously accepted standards … this seems to involve attitude plus knowledge of facts plus some thinking skills" (Russell, cited in d'Angelo, 1971, p. 6). In short, Russell's equation is:

Attitude + Knowledge + Thinking Skills = Critical Thinking

Although there are several goals when developing critical thinking skills, at least two stand out as important regardless of context—(a) using thinking skills to overcome fallacies and biases and (b) understanding information at a deep, meaningful level. Keep these in mind as you work your way through this book. By the time you finish this book, we hope that you will have improved in both of these areas.

What's Critical about Critical Thinking?

> Critical thinking requires knowledge *and* courage. Neither is sufficient in itself. Knowing but not daring is smart but cowardly. Daring without knowing is bold but unwise—it makes one vulnerable to propaganda and fake news.
>
> (Greg Gigerenzer, 2020, p. 198)

The "critical" part of critical thinking denotes an evaluation component. Sometimes the word "critical" is used to convey something negative, as when we say, "She is a critical person." But, evaluation can and should be a constructive reflection of positive and negative attributes. When we think critically, we are evaluating the outcomes of our thought processes—how good a decision is or how well a problem has been solved. Critical thinking also involves evaluating the thinking process—the reasoning that went into the conclusion we've arrived at or the kinds of factors considered in making a decision. Daydreams, night dreams, and other sorts of thinking that are not engaged in for a specific purpose are not subsumed under the critical thinking category. Neither is the type of thinking that underlies our routine habits, which although goal-directed, involve very little conscious evaluation, such as getting up in the morning, brushing our teeth, or taking a usual route to school and work. These are examples of **nondirected or automatic thinking**. Other examples of *noncritical thinking* include the rote recall of information (e.g., listing state capitals) or the failure to consider evidence that might support a conclusion that you do not like.

No set of skills can guarantee a desirable outcome. The future is always unknown and there can never be guarantees about the future, even for the best of thinkers. A substantial increase in the likelihood of a desirable outcome is the best that critical thinking can promise, and it is the best hope for the future that anyone can offer.

The focus of this book is on the development and improvement of those skills that characterize clear, precise, purposeful thinking. It is a practical book, based primarily on applications of cognitive psychology to memory, reasoning, problem solving, creativity, language, and decision making. John Dewey, the pioneering American educator identified "learning to think" as the primary purpose of education in 1933 so it has long history in education.

Although psychology has been concerned with the way people think for much of its 100+ years of existence as an academic discipline, cognitive psychology, the branch of psychology that

is concerned with thought and knowledge, has virtually dominated scientific psychology for the past 60 years. Cognitive psychologists are concerned with learning about the skills and strategies used in problem solving, reasoning, and decision making and the way these abilities relate to intelligence. All of this interest in human thinking processes has given birth to a new area of psychology that has come to be known as **cognitive process instruction**. Its goal is to utilize the knowledge we have accumulated about human thinking processes and mechanisms in ways that can help people improve how they think. For example, by examining correct and incorrect responses in a variety of situations, psychologists have found that, at least some of the time, most people's spontaneous and intuitive approaches to solving problems are wrong. Furthermore, psychologists can often predict when an incorrect response will be made either because of the nature of the problem or because of common biases that a problem solver may bring to the problem. This knowledge is already being put to use to solve a host of applied problems that range from providing military personnel with map reading skills to designing "user-friendly" computer programs. Ariely (2009) has written extensively on what he calls "predictably irrational" behavior. The main theme of Ariely's writing is that psychologists can predict with a high level of accuracy the type of irrational thinking and behavior most people will engage in when they are faced with certain information and need to make a decision. By understanding how and when we are irrational, we can make better decisions, and by extension, we become better thinkers.

TWO TYPES OF THINKING—FAST AND SLOW

> Bush told me, "I am a gut player, not a textbook player."
>
> (Bob Woodward, quoted in Love, 2010, para. 19)

Daniel Kahneman, the cognitive psychologist famous for his ground-breaking work on how people think and decide, has popularized the idea that there are two broad types of thinking, System 1 and System 2. System 1 is what is commonly thought of as intuition. It is automatic, effortless, and when it is good, it is most likely associated with expertise. The quote about the way George Bush, a former president of the United States, described his thinking as from the "gut" is an example of System 1 thinking. By contrast, System 2 thinking is slow, effortful, and deliberate, and thus close in its definition to critical thinking, when it is done well.

System 1 Thinking

> Intuition is not subliminal perception; it is subtle perception and learning—knowing without knowing that you know.
>
> (Michael Shermer, 2003, para. 11)

To understand the distinction between System 1 and System 2 thinking, try this simple exercise:

1 A bat and a ball cost $1.10
The bat costs $1.00 more than the ball.
How much does the ball cost? (Kahneman, 2011, p. 44)

Ok raise your hand if you said $.10—obvious and intuitive answer. If you answered $.10, the answer came to you in flash. It is as though you did not have to think at all. Unfortunately, you

also came up with the wrong answer, if you said $.10. With this answer, the bat is $1 and the ball is $.10, which makes the bat $.90 more than the ball. Of course, you could use simple algebra:

Bat + Ball = $1.10
and
Bat = Ball + $1.00

Now substitute the definition of Bat (it equals Ball + .10) into the first equation and you get

Ball + $1.0 + Ball = $1.10
2 Ball = $1.10 – $1.0
2 Ball = $.10
Ball = $.05

If you gave the incorrect, but intuitive answer, you are in good company. More than half of the students at Harvard, MIT, and Princeton gave this answer, and more than 80% of the students at less selective universities did as well (Frederick, 2005). The **Cognitive Reflection Test** is a 3-question test that assesses the extent to which people tend to give intuitive answers to simple problems like this one. The other two questions are

2 If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? ___ minutes
3 In a lake, there is a patch of lily pads. Every day, the patch doubles in size. It if takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake? ____ days

How did you do? Did you answer 100 days for the second question? Buzz—as you probably guessed by now, that is the wrong answer. The correct answer is 5 days. The third problem appeared in all earlier versions of this book and was originally attributed to Fixx (1978, p. 50). The only way to solve this problem is to work backwards. Can you solve it with this hint? If the lake is covered on the 48th day and the area covered by the lilies doubles every day, how much of the lake is covered on the 47th day? The answer is half. Thus, by working backward, the problem is easy to solve.

Respondents who gave the intuitive, fast, and in this case, wrong responses, were less likely to delay rewards (for example, they were more likely to prefer getting $5 now than $7 next week), thus suggesting that people who rely more on intuitive and quick thinking differ in other important ways.

Intuition

> It's no secret that when researchers have pitted intuition against statistical prediction, the formula usually wins. Statistical prediction is fallible. But for predicting future behavior, human intuition—even professional intuition—is even more fallible.
>
> (David Myers, 2010, p. 376)

We love stories about human intuition. Diane remembers spending an evening with a friend, who suddenly said that he was thinking about a third person whom we both knew well. This

third friend was "very pregnant," a strange description for someone who has already gone past the projected due date that was given to her by her obstetrician. Wouldn't it be weird if this overdue friend was having her baby just when we thought about her? Well, actually no, although it might seem that way.

The intuitions of experts differ from everyday intuitions in important ways—most importantly, they are more likely to be useful if (1) the area of expertise is one that is governed by regularities and (2) the expert had repeated experience with immediate feedback in that area. It seems that these two criteria can explain why "professional intuition is sometimes marvelous and sometimes flawed" (Kahneman & Klein, 2009). Consider chess players. Expert chess players actually organize the information on a chess board into meaningful units in just fractions of a second (de Groot,1965), and expert Scrabble players can recall more information on Scrabble boards, with those players with the longest history of playing outperforming experts who played fewer years (Halpern & Wai, 2007). In other word, experts developed a quick knowledge in these domains that have regular rules that can be learned over time. Years of practice can pay off with superior abilities to recognize situations, but only if the expert has received immediate feedback about earlier decisions and has been able to use that feedback in ways that make him a "true" expert in a field where there are regularities.

By contrast, the intuitions of experts where the domain is highly irregular or they do not get immediate feedback for their decisions are not any better than those of a novice. If you recall the early days of the 2020 (COVID-19) pandemic, expert opinions ranged from "no risk" to "serious risk"; from no need to wear face masks to face masks save lives, and so on. This was a novel virus that was similar to earlier ones, but different enough that even the top experts in the world could not agree on how long the virus would remain a threat and how to "flatten the curve"—reduce the increase in the number of cases. (See Chew, 2020, for a discussion of what the coronavirus can teach us about critical thinking.) Similarly, Kahneman reviewed evidence showing that the professionals who select stocks for investment are no better at this task than novices because the field is so irregular; they cannot learn what makes some stocks increase in value and others decrease.

Intuitions are like visual illusions in some ways. They can sometimes help us understand the world, but they are often distorting and very difficult to ignore (see Figure 1.1).

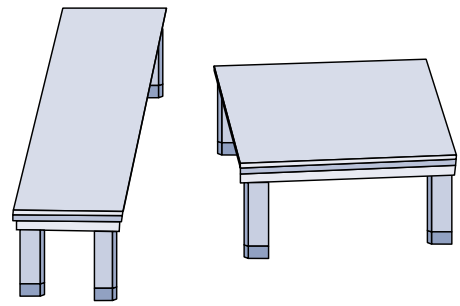

FIGURE 1.1 These two table tops appear to be very different in their size and shape, but if you cut out a piece of paper to fit over one table top, you would find that it also fits perfectly over the other table top. This is a common visual illusion.

Thinking illusions, such as the belief that our intuitions are most often correct, are similar to visual illusions. With effort, we can learn that our intuitions are often wrong, and we can use that knowledge to be wary of our own intuitions and those of others. Additionally, we can learn when intuitions are more likely to be correct—when they are done by an expert who has had repeated experience with feedback in her field of expertise.

In deciding when to trust the intuitions (or fast thinking) of an expert, ask these three questions: How much experience does the expert have that is directly relevant to the task? Is it a task where there are regular outcomes that can be learned from experience? Is the "expert" in a field where there is immediate feedback about the quality of the decisions that were made? This idea resonated with Peter Senge, an organizational expert who wrote extensively about organizations that learn. He asserts that people don't learn directly from experiences, even though they believe that they do, because they rarely experience the consequences of their important decisions.

System 2 Thinking

> Both self-control and cognitive effort are forms of mental work.
>
> (Daniel Kahneman, 2011, p. 41)

Critical thinking is System 2 thinking. It is slow, deliberate, and effortful. It is also the engine that drives System 1 thinking, because the fast recognition processes of System 1 were originally learned in a deliberate and effortful way. If system 1 can be thought of as intuition then System 2 can be thought of as critical thinking. It involves weighing evidence, evaluating risk, calculating probabilities, judging credibility and similar activities that are the hallmark of good thinking. Thinking can be rational and people can learn to engage in rational thinking. We can learn from our mistakes and by keeping track of them, make them less likely to occur in the future.

If you are familiar with Malcolm Gladwell (2005), the popular writer for *The New Yorker* magazine and author of many books, you probably know about his notion of "Blink." According to Gladwell, it is sort of intuitive thinking that happens rapidly—in the time it takes to blink. In his book by this name, he tells many stories about the way professionals arrived at good decisions without going through the hard work and time-consuming effort to consider all available and relevant information. Indeed, there are many good stories where the rapid cognitive processes of System 1 thinking do a good job. But it is important to keep in mind that these stories tend to be about experts who spent many thousands of hours doing the hard work of System 2 thinking before they got good at making fast, intuitive decisions. Holt (2011) summed up the relationship between System 1 and System 2 thinking this way: "If you've had 10,000 hours of training in a predictable, rapid-feedback environment,—chess, firefighting, anesthesiology—then blink. In all other cases, think" (para. 23). This is good advice. You will learn the skills associated with System 2 Thinking throughout this book, and after you put in the hard work of developing expertise, then you can be more confident of your intuitions.

"I'm sorry, Jeannie, your answer was correct, but Kevin shouted his incorrect answer over yours, so he gets the points."

IF CRITICAL THINKING IS SO IMPORTANT, THEN WHY IS IT SO HARD?

There are many reasons why people often find critical thinking difficult. Here are just a few of them:

Desire Is Often More Powerful Than Critical Thinking

Congratulations! You just won $45,000. Just send us an administrative fee of $3000, and we will deposit your winnings into your bank account? Really??

Several writers have pointed out the role of what people want to be true as a determinant of what they believe or do (Gigerenzer, 2020). How can we explain why people join cults, take bogus cures for cancer, or spend their money in the belief that they will win the coveted Publisher's Clearing House (PCH) Sweepstakes? PCH Sweepstakes is advertised as the chance to "win $7,000 a week for life" (Publisher's Clearing House, 2019). We are urged to "Act Now! You could be set for life!". Would only a crazy person believe their claims? Research has shown that anyone can be fooled by claims and advertisements. Older people may be particularly vulnerable, and are often the target of these scams, but anyone can be fooled. Pratkanis (2020) served as an expert witness in a court case that epitomizes the predominance of wishful thinking over critical thinking. He showed the court that many people believed that they already won the PCH sweepstakes or that their chances of winning would improve if they spent large sums of money on magazines sold by Publisher's

Clearing House. There were not just a few "crazies" who fell for the flim-flam. Pratkanis must have been convincing because PCH paid $34 million for consumer education funding as a result of the lawsuit.

Overconfidence

Have you ever bought a lottery ticket? Do you know what the odds are against your hitting the jackpot? The laws of probability dictate that you should expect to lose, yet countless numbers of people expect to win. According to an article in BankNews (2019, para. 3), 18% of Americans are "basing their retirement plans on hopes that they will win the lottery", including 26% of millennials, 19% of Gen Xers, and 13% of baby boomers. We hope that anyone who is planning to win the lottery to support themselves in old age stays very healthy so they can continue to work into old age.

There is a large literature on overconfidence and how it affects decision making. For example, in a multi-country study of incumbent politicians, the researchers found that politicians who were overconfident in their belief that they will be re-elected made more risky decisions than politicians whose beliefs about the likelihood of being re-elected more closely matched their actual chance (Sheffer & Loewen, 2017). Being confident beyond what is reasonable is associated with many risky decisions.

Lazy Thinking

Critical thinking is hard work. It is effortful and often we are all "lazy thinkers" (Pennycook & Rand, 2019). People are cognitive misers—we often do not expend the effort to think critically. In a study of lazy thinking, the researchers presented people with a mix of real and fake headlines. Respondents were asked to rate the perceived accuracy of each headline and whether or not they would share the headline on social media such as Facebook. The respondents also took a cognitive reflection test, which measures the tendency to override an intuitive response and replace it with one that is more analytical (Thomson & Oppenheimer, 2016). Recall from an earlier section of this chapter the Cognitive Reflection Test was used to assess the shift from Type 1 to Type 2 thinking. Pennycook and Rand found a strong relationship between scores on the Cognitive Reflection Test and judgments about the likelihood that a false headline was true. In other words, individuals who provided more analytic answers on the Cognitive Reflection Test were less likely to believe that false headlines were true. These results support the idea that effortful thinking can help people avoid believing false news.

Conspiracy Theories

Was Barack Obama born in Kenya and therefore not eligible to become president of the United States? Did astronauts really land on the moon or are all of the photos and accounts of the landing fake news? Were the events of 9/11 caused by the United States government? Was your response to these questions, "Huh!" These are just three of many conspiracy theories that are held by a substantial number of people. Why would anyone believe these conspiracies?

In a review article on conspiracy theories, Shermer and Linse (n.d.) explain that **conspiracy theories** are about powerful people who work together in secret to accomplish a sinister goal. If someone believes in a conspiracy theory that person is likely to believe in

several. A key ingredient is that the theory is resistant to falsification. They do not believe in the random nature of many events—instead for believers everything happens for a reason. Political ideologies also play a role. For example, people on the left of the political continuum are more likely to believe that an international conspiracy is covering up the harm caused by genetically altering food, and those on the right of the political continuum are more likely to believe that climate change is a hoax.

How can we know if a conspiracy theory is a bogus belief? After all, there are some real conspiracies and cover-ups. Shermer and Linse suggest the following test questions: Would the people or groups responsible for the action have to have superhuman powers to make it happen? If the United States government really was responsible for the events of 9/11 it would take a huge number of people to coordinate the actions (e.g., military, pilots willing to die for this mission, and government officials). Is it possible that this could happen without any evidence and the silence of so many people? Are there alternative explanations that are possible? Would data such as a copy of Obama's birth certificate suggest a different belief? Do the believers see relationships among events that could be attributable to other explanations or chance? Is the theory contrary to beliefs from well-respected individuals with expertise in the field? Keep these questions in mind when you are confronted with a conspiracy theory.

Self-Serving Biases

Suppose you read an article in the paper that describes a study done on the intelligence of two groups of people living on a remote island you never heard of. The researchers found that Group A was smarter than Group B. You probably would not care much. Now suppose that the article compared the intelligence of groups of people living in your country and found that the group you belong to is less intelligent than people in the other groups. WHAT!!! My group is less intelligent—hell no! Or imagine the reverse, your group is the most intelligent. Well, you were not surprised with this finding. Your willingness to believe certain information reflects a **self-serving bias**—it is the need to maintain beliefs that are favorable to you.

In an interview with NBC's *Meet the Press*, former mayor and (at the time of writing this chapter attorney to the President of the United States), Rudi Giuliani, argued that "Truth isn't truth" and suggested that "alternative facts" should be considered just as valid as the *actual* facts. In a careful analysis of the exchange between Giuliani and Chuck Todd, the moderator of *Meet the Press*, author Gleb Tsipursky pleads with his readers (Tsipursky, 2018, August 21):

> To preserve our democracy from destruction by such tactics requires an organized effort to unite all who care about truth across the political spectrum. Regardless of what Giuliani says, or what the industry-funded scientists claim, truth is truth, and it must be protected for the sake of our shared future.

One hallmark of critical thinking is the ability to validate what is true and to question any attempt to get us to believe something that is obviously in the speaker's self-interest. Don't like the facts—just make up new ones—that is not how critical thinking works.

In a court case in 2019, Exxon Mobil, the oil giant was accused of deceiving and confusing the public by cherry-picking data and using bogus "experts" to support the belief that fossil fuels do not play a role in climate change (Rust, 2019). This is a self-serving

bias because the information they provided allowed Exxon Mobil to continue to earn high dividends for its stock holders. People who gained from this belief were more likely to accept it than those who did not.

Critical Thinking Is Also Emotional and Social

Consider some of the topics already presented in this chapter. Did any of them make you feel uncomfortable? Consider the opening scenario. If you believe that cupping has medical benefits (and it is a good bet that some readers of this book do), you probably reacted with some anger or confusion. Often the skills of critical thinking lead to beliefs that are in opposition with a prior belief—it could be in the healing properties of crystals, or the use of astrology as a measure of personality, or the belief that the moon landing never occurred. There is also social pressure. Suppose everyone in your family believes that important information about your future can be "read" from the lines on the palms of your hands. It is difficult to question the beliefs of those around you. Social cohesion is important to all of us because it allows us to be a part of a group, but when we question some of the beliefs held by others in the group, we may experience anger or exclusion from them. The forces for conformity are strong and if you question them, there is the possibility of social exclusion. No wonder this is so hard. You may find that you can use critical thinking skills in all areas except for the ones where you already have strong beliefs (Buckner & Buckner, n.d.).

As you work your way through this book, you will see even more reasons why critical thinking is so damn hard.

CHANGING HOW PEOPLE THINK: SHOULD IT BE DONE?

> We know that the average American, because of changes in the economy at home and abroad, will change work seven or eight times in a lifetime …. If that is true, it is clear that we need an agenda as a people for lifetime learning.
>
> (U. S. President Bill Clinton "Clinton's message" 1994, p. 6A)

The whole idea of influencing the way people think may seem scary. It suggests terms like "mind control" and "propaganda," or perhaps even a "Big Brother," like the one in Orwell's (1949) chilling novel *1984*, who knew what you were thinking. In reality, though, critical

thinking is an antidote to the kind of mind control that worried Orwell. Learning the skills of clear thinking can help everyone recognize propaganda and thus not fall prey to it, analyze unstated assumptions in arguments, realize when there is deliberate deception, consider the credibility of an information source, and think a problem or a decision through in the best way possible.

When we discuss the topic of critical thinking with students and other people with whom we come in contact we are sometimes told that there is no such thing as critical thinking because different viewpoints are "all a matter of opinion" and that everyone has a right to his or her own opinion. They argue that a "better way to think" does not exist. We certainly agree that we all have the "right" to our own opinion; however, some "opinions" are better than others. Everyone has the right to believe in phenomena such as astrology and extra-sensory perception even if there is no sound evidence to support the existence of these phenomena. If someone wants to have an illness sucked from his body with warmed cups or buys a so-called Power bracelet as a way of improving athletic prowess that is purely bogus, why should anyone care?

James Randi, a magician and escape artist who is best known for his work in debunking claims of psychics and others had a certified $1 million fund that would be given to anyone who could legitimately demonstrate paranormal ability under test conditions. There is a long list of applicants who wanted to win the money including psychics, clairvoyants, friends of the dead, someone who claimed she could make people urinate using the power of her mind, and even stranger claims. The $1 Million Paranormal Challenge was never claimed. After 19 years with the funds unclaimed, Randi also known as "The Amazing Randi" retired in 2016. His board of directors decided to use the money to fund grants each year instead of continuing with the stream of paranormal claims and other sorts of claims that were never shown to be true under transparent conditions and use of experimental methods (James Randi Educational Foundation, 2015). One of the first winners of these grants was won by Susan Gerbic (2019) who exposed celebrity psychics.

Here is a sobering fact: An unacceptable number of decisions made in the process of medical diagnosis are wrong; error is estimated to occur in 10–15% of decisions, and possibly more (Croskerry, 2015). Many of these errors are due to problems in the thinking process, not lack of knowledge. For example, a common error is "**search-satisficing**," which is the tendency to stop looking for a cause for a problem as soon as one possible cause is identified. There are many other biases that we think that you will learn about as you work your way through this book. If we were successful in teaching physicians just a few of the most common biases, we might be able to reduce the numbers of errors they make.

There are countless examples of the need for critical thinking. In every political campaign, candidates tell voters that they are opposed to waste, fraud, pollution, crime, and overpaid bureaucrats. These speeches are inevitably followed with loud cheering and applause. (Pay attention to this when you watch the next political convention—regardless of the party.) What's wrong with these speeches? The candidates never really say anything. I've never heard any candidate claim to be *for* waste, fraud, pollution, crime, or overpaid bureaucrats. Voters should ask them to be more explicit about their goals, how they would accomplish them, and where the money would come from to finance political plans. The most precious commodity of any country is thinking, educated people. We must make this the goal of education.

EMPIRICAL EVIDENCE THAT THINKING CAN BE IMPROVED

> Everyone agrees that students *learn* in college, but whether they learn to *think* is more controversial.
>
> (Wilbert J. McKeachie, 1992, p. 3)

If you have been thinking critically about the idea of improving how you think, then you've probably begun to wonder if there is any evidence that thinking can be improved. (Good for you if you already thought about this!) Although there has been some debate about whether it is possible to produce long-lasting enhancements in the ability to think effectively, we now have a considerable body of evidence that thinking skills courses and thinking skills instruction that is embedded in other courses can have positive effects that are transferable to many situations. Numerous qualitatively different forms of outcome evaluations for thinking courses provide substantial evidence for the conclusion that it is possible to use education to improve the ability to think critically, especially when instruction is specifically designed to encourage the transfer of these skills to different situations and different domains of knowledge. In fact, it is difficult to identify any aspect of critical thinking that could not be taught and learned. We learn mathematics in the belief that mathematical skills can be used in real world contexts where they are needed; similarly, we learn writing and speaking skills in the belief that learners will use these skills when they write or speak in any context. When students take courses designed to improve their ability to work with numbers, write, or speak, most students show improvements. There is no reason why we should believe that instruction in critical thinking would not show the same positive effects as when teaching mathematical, writing or speaking skills. Here is a sampling of some recent positive outcomes (numerous older studies can be found in earlier versions of this book):

1. Researchers in the Netherlands examined the effect of critical thinking instruction on training and transfer in complex decision making. One group of students received the instruction while working with realistic scenarios that required complex decisions and the other group used the same scenarios, but did not receive the training (Helsdingen, van den Bosch, van Gog, & van Merrienboer, 2010). The researchers concluded that "The results of this study warrant the implementation of critical thinking instruction … for decision makers that have to operate in complex and highly interactive dynamic environments" (p. 537).
2. In a report in the prestigious journal *PNAS* (*Proceedings of the National Academy of Sciences*), researchers described a training program in which they taught college students the critical thinking skills associated with the scientific method (Holmes, Wieman, & Bonn, 2015). As you might hope, these researchers used the scientific method to test their intervention—they had control groups, multiple outcome measures including short-term and long-term gains, and measures that included how well these skills transferred to novel problems. They document very large gains in how students thought about experimental designs following the instruction. They concluded that there were "significant and sustained improvement in

students' critical thinking behavior" for students who received the critical thinking instruction.

3 In a study with high school juniors and seniors, Marin and Halpern (2011) taught a group of students selected critical thinking skills—analyzing arguments, recognizing reasons, formulating conclusions, and resisting persuasive appeals. The researchers used a comparable group that used a textbook that made vague claims that it fostered critical thinking to serve as a control. Students in the critical thinking classes showed the greatest gain in critical thinking, with generally small effects for the group that used a vaguely defined notion of critical thinking. Most importantly, the skills that were learned with explicit instruction transferred to the novel scenarios.

4 In a series of studies researchers used a computerized learning game that taught critical thinking skills that are generally used in understanding and critiquing research (Forsyth et al., 2013; Forsyth et al., 2012). These skills included operational definitions, experimental control, experimenter bias, causal claims, and sample size, among others. We found that, compared to control groups, students who played the computerized game showed better learning of these skills both immediately after playing the game and after a delay (Halpern et al., 2012) and substantial gains were made by students in open-admissions community colleges, state universities, and at a private elite liberal arts college. Thus, students at different levels in their education can show gains in thinking skills.

All of the diverse findings (and many others that are not reviewed here because the relevant research literature is huge) point to the same conclusion: students can learn to think more critically when they receive instruction that is designed for this purpose.

IS CRITICAL THINKING A BYPRODUCT OF A GOOD EDUCATION?

> Freshmen who enter higher education at the 50th percentile would reach a level equivalent to the 57th percentile of an incoming freshman class by the end of their sophomore year. Three semesters of college education thus have a barely noticeable impact on students' skills in critical thinking, complex reasoning, and writing.
>
> (Richard Arum & Josipa Roksa, 2011, p. 35)

The evidence is clear: We can get sizable gains in critical thinking when teachers deliberately teach for critical thinking. But, what if teachers don't? Do students become better thinkers as a routine part of getting a good education? In fact, many do not. Arum and Roksa (2011) make this point in their condemnation of what happens in many college classes. They followed 2300 students at 24 universities over four years. They concluded that more than one-third showed no improvement in critical thinking. Critical thinking does not automatically result as a byproduct of standard instruction in a content area. Critical thinking instruction needs to focus overtly and self-consciously on the improvement of thinking, and the learning experience needs to include multiple examples across domains in order to maximize transfer.

LEARNING TO THINK CRITICALLY: A FOUR PART MODEL

The model that we propose for critical thinking instruction consists of four parts (Butler & Halpern, 2011; Halpern, 1998):

1 Explicitly learn the skills of critical thinking
2 Develop the disposition for effortful thinking and learning
3 Direct learning activities in ways that increase the probability of transcontextual transfer (structure training)
4 Make metacognitive monitoring explicit and overt.

Let's consider each of these parts.

A Skills Approach to Critical Thinking

As you work your way through the chapters in this book, you will come across many different thinking skills, with each chapter containing those skills that are especially useful in thinking about the chapter topic. For example, the thinking skills used in understanding likelihood and uncertainty are presented in that chapter.You may be wondering what a "thinking skill" is. Some examples should help. Here is a list of some generic skills that are important in many situations.

A critical thinker will:

- recognize semantic slanting and guilt by association
- seek out contradictory evidence
- use the metacognitive knowledge that allows novices to monitor their own performance and to decide when additional help is needed
- make risk:benefit assessments
- generate a reasoned method for selecting among several possible courses of actions
- give reasons for choices as well as varying the style and amount of detail in explanations depending on who is receiving the information
- use numerical information including the ability to think probabilistically and express thoughts numerically
- understand basic research principles
- present a coherent and persuasive argument on a controversial, contemporary topic
- synthesize information from a variety of sources
- determine credibility and use this information in formulating and communicating decisions.

Critical thinking instruction is predicated on two assumptions: (a) there are clearly identifiable and definable thinking skills that students can be taught to recognize and apply appropriately, and (b) if recognized and applied, the students will be more effective thinkers. Thus, one part of the model for learning to become a better thinker is learning how to use the skills of critical thinking and how to recognize when a particular skill (or set of skills) is needed.

THE DISPOSITION FOR EFFORTFUL THINKING AND LEARNING

> All man's dignity lies in thought.
>
> (Blaise Pascal, 1670, p. 83)

No one can become a better thinker just by reading a book or even by just learning a set of thinking skills that would be useful, if they were used. An essential component of critical thinking is developing the attitude or disposition of a critical thinker. Good thinkers are motivated and willing to exert the conscious effort needed to work in a planful manner, to check for accuracy, to gather information, and to persist when the solution is not obvious or requires several steps.

In an empirical test of the relationship between a disposition to think critically and actual performance on a test of critical thinking, Butler (2012) found that adults who reported that they were more likely to engage in the effortful process of thinking (e.g., less likely to rely on gut decisions or to prefer one example to a well-conducted study or were more likely to research products before buying) had higher scores on a critical thinking assessment and actually engaged in fewer negative behaviors that were indicative of poor thinking (e.g., rented a movie but had to return it without watching it, bought new clothes but never wore them, got locked out of the house) than those who were less inclined to think critically.

Many errors occur not because people can't think critically, but because they do not. One of the major differences between good and poor thinkers, and correspondingly between good and poor students, is their attitude—the inclination or habit of using critical thinking skills. A critical thinker will exhibit the following dispositions or attitudes:

1. Willingness to Plan

> [P]rospective employees [will] one day add lines to their resumes indicating that they have reached end game playing in WoW (World of Warcraft)
>
> (Leiser Silva & Elham Mousavidin, 2015, p. 178)

We have watched thousands of students (literally) take exams. There are always some students who begin to write as soon as the exam hits their desk. They just plow ahead and begin writing before they begin thinking. Not surprisingly, the results are a disoriented jumble that often bears little relation to the questions being asked. When asked a question in class, they will often answer with the first idea that comes to mind. These students need to learn to check their impulsivity and plan their response. They should be outlining or diagramming the structure of a response before they begin to write. Planning, the invisible first step in critical thinking, is essential. "Plans specify a series of actions designed to produce a desired future outcome" (Baumeister & Vohs, 2016, p. 9). Planning seems to be an important component for changing many behaviors, especially health-related behaviors such as sticking to an exercise plan, eating in ways that promote health, and avoiding drug and alcohol abuse (Ludwig, Srivastava, & Berkman, 2019). There is a diverse research literature on the benefits of planning in business, politics, and almost every other area you can think of. Regardless of the content—it is useful to plan how you will think and act. Plans are prescriptive descriptions about what to do

and they prevent habitual responses which may not work. With repeated practice, anyone can develop the **habit of planning**.

Here's something that will interest the over 8 million players of the Massively Multiplayer, Online Role-Playing Game (MMORPG) World of Warcraft (WOW). In this game each player has an avatar who advances by completing challenges such as quests and dungeons (Silva & Mousavidin, 2015). The researchers (one of whom was at the highest level at WOW at the time the research was published) found that the best players planned a sequence of actions involving economic and social thinking to achieve their goals. Over time, the planning phase became habitual. They believe that the strategic planning skills used in WOW are the same ones that are useful in business.

Self-regulation is a popular concept in the psychological research literature. It is a complex term with multiple components, which includes using feedback, monitoring comprehension, assessing progress toward a goal, and making judgments about how well something is learned (Bednall & Kehoe, 2011). There is a voluminous literature showing that self-regulation is important in learning. It is now clear that critical thinkers are self-regulated learners. Researchers taught college students how to use self-regulatory behaviors and they found that when compared with control groups, students who learned how to self-regulate performed better on a test that required detecting and explaining thinking fallacies.

2. Flexibility

In a classic old book, Rokeach (1960) talks about rigidity and dogmatism as the characteristics of a "closed mind." A person with a closed mind responds negatively to new ideas by stating, "That's the way I've always done it." Another common retort that shows the unwillingness to consider new ideas is the well-worn phrase, "If it ain't broke, don't fix it." This sort of close-minded response cuts off consideration of new ideas. By contrast, an attitude of **flexibility** is marked by a willingness to consider new options, try things a new way, reconsider old problems. Cognitive flexibility is the ability to change how we think about something—to see things from another person's point of view, consider multiple options, think of several ways to respond, and seek information that may not be readily available. An open-minded person is willing to suspend judgment, gather more information, and attempt to clarify difficult issues (Barak & Levenberg, 2016). This does not mean that all opinions are equally good or that judgment should take a back-seat to openness. It does not mean accepting every nonsense opinion that is offered. It does mean, though, that a critical thinker is willing to think in new ways, review evidence, and stick with a task until all reasonable options have been considered.

Baron (2020) uses the term "actively open-minded thinking" as a standard for good thinking. The underlying idea is that thinking is subject to many biases (more on this throughout this book) and we need to actively seek alternative possible solutions to become critical thinkers. Although Baron uses the term "actively open-thinking" it is basically the same as flexibility, and critical thinkers need to apply this attitude to avoid biases.

3. Persistence

> You may be disappointed if you fail, but you are doomed if you don't try.
>
> (Beverly Sills, 1929–2007)

There are many factors that influence academic and career success, but **persistence** may be the most important one (Andersson & Bergman, 2011). It is the willingness and ability to keep at a task. It is a key factor in successful problem solving. Closely related to persistence is the willingness to start or engage in a thoughtful task. Some people look at a seemingly difficult task and opt not to even begin the thinking process. They are defeated at the start. Good thinking is hard work that requires diligent persistence. It can make you as tired as any physical labor, but can be much more rewarding. In a comparison of students who were unsuccessful in mathematics with those who were successful, researchers found that much of the difference in success rates was directly attributable to differences in attitudes. The unsuccessful students believed that if a problem could not be solved in less than 10 minutes, then they would not be able to solve it. By contrast, the successful students persisted in working on difficult problems (Schoenfeld, 1985).

4. Willingness to Self-Correct, Admit Errors, and Change Your Mind When the Evidence Changes

> In science it often happens that scientists say, "You know that's a really good argument; my position is mistaken," and then they would actually change their minds and you never hear that old view from them again. They really do it. It doesn't happen as often as it should, because scientists are human and change is sometimes painful.
>
> (Carl Sagan, 1934–96, quoted in Goodreads)

We all make mistakes. In fact, creative thoughts and actions would not be possible if we were unwilling to make mistakes, at least some of the time. Instead of becoming defensive about errors, good thinkers can acknowledge them and learn from them. Unfortunately, there is a widespread tendency to justify our mistakes—our faulty beliefs, our bad decisions. In a delightful book, Tavris and Aronson (2007) review multiple political and private mistakes. A main deterrent to admitting mistakes is **self-justification**. Self-justification is extremely strong because it keeps our image of ourselves intact. For example, is it important to think of yourself as an informed and intelligent citizen? For many of us, this is an important component of our self-image. Suppose that you believed that there really were "weapons of mass destruction in Iraq" at the time when the President of the United States was urging its allies to protect themselves and the future of their country by invading Iraq. Later, the overwhelming evidence shows that there were no weapons of mass destruction. What now? Many people chose to ignore the evidence and maintain their original belief. It is not hard to see why. By maintaining, even strengthening the original belief, believers can continue to see themselves and to convince others that they were not wrong about something so important. Self-justification, which is making excuses for a belief or behavior, is a very strong human tendency and can be found everywhere—it is not just for politicians. The disposition to be self-critical (evaluative) and consider when a mistake is a learnable moment and not a time for the auto-pilot of self-justification is a hallmark of critical thinkers.

It is interesting to note that the general public usually does not like it when a public figure changes his or her mind, especially when the change is away from a conclusion that was popular. However, if a person is open to a fair evaluation of new information, sometimes that information will lead to a different conclusion. It would be foolish to hold to an old conclusion

or belief when it is no longer warranted. The ability to change one's conclusion when new or better information becomes known is not "waffling" or some other negative term that is used to describe someone whose views change as readily as the shifting direction of the wind. What is needed is a new term that has positive connotations to be used for critical thinkers who are willing to change conclusions when sound evidence warrants a change. Unfortunately, this is one attitude of critical thinking that is still all too rare.

5. Being Mindful

In order to develop basic thinking skills, it is necessary to direct your attention to the processes and products of your own thoughts. It is the opposite of the "automatic pilot" that we use for routine tasks like setting the dinner table, getting to school or work every day, or watching television in the evening. Learning requires a mindful engagement with the task and materials. Langer (1989) told a humorous personal story about a case of mindlessness that makes this point. When shopping one day, the clerk told her that she had not signed the back of the credit card she was using. Langer signed the card, and then handed it back to the clerk. The clerk then processed the sale and had Langer sign the credit slip. Then, dutifully, as she had no doubt been instructed, the clerk checked the signature on the back of the newly signed credit card with the signature on the credit slip. She never realized that she had just seen Langer sign both! As long as we respond in a mindless or routinized way, problems worth solving will never be recognized, and creative solutions will be missed.

6. Consensus-seeking

Committee and group organizational structures are most often the norm in the world of work. Critical thinkers need to be predisposed to seek ways in which consensus among group members can be achieved. They maintain an awareness of the social realities that need to be overcome so that thoughts can become actions. Consensus-seekers need high-level communication skills, but they also need to find ways to compromise and to achieve agreement. Without this disposition and related interpersonal skills, even the most brilliant thinkers will find that they cannot convert thoughts to actions.

Consensus-seeking does NOT mean caving in to majority opinion, and it does not mean forcing others to agree with you. It is a disposition that allows individuals to accept what is good or true about an alternative position as a way of gaining support for one's own position. Consensus-seeking refers to an openness in thinking that allows members of a group to agree on some aspects of a solution and disagree on others—but the goal is to allow other people and yourself to express doubts while working toward a solution that can be achieved.

You may be thinking that this disposition is different from the others—it may seem less like something that applies to critical thinking, but stop and think about it. (What else would you expect us to say?) The ability to gain consensus can be powerful. In a handbook on consensus, the authors conclude that a consensus of opinions among experts on controversial topics such as climate change can neutralize the negative opinions of people who are opposed because of their political ideology (Cook, van der Linden, Maibach, & Lewandowsky, 2018).

TRANSFER OF TRAINING

In becoming a better thinker, it is important to have a large repertoire of critical thinking skills and to be willing to engage in the effortful process of using them. The third component of this model involves recognizing when critical thinking is needed, so that you can select the most appropriate skills for the situation. This is the Achilles' heel of transfer. The problem in learning thinking skills that are needed in multiple contexts is that there are no obvious cues in the context to trigger the recall of the thinking skill. Critical thinkers need to create the recall cues from the structural aspects of the problem or argument, so that when the structural aspects are present, they can serve as cues for retrieval.

When critical thinking skills are learned so that they transfer appropriately and spontaneously, critical thinkers can focus on the structure so the underlying characteristics become salient instead of the domain specific surface characteristics. An example should help here because the idea of transferring skills to novel areas is highly abstract.

Suppose that you understand the way contrast effects can influence one's judgment. For example, if you are offered several part-time jobs that pay $10 an hour, $13.50 an hour will seem like more money than if you had been offered several part-time jobs that pay $14 an hour. Even if you know that contrast effects can influence judgments, will you be able to recognize the power of contrast effects on your judgment in a totally different situation, such as when your friend begins a story about his "brush with the law" by telling you about all of the people from your old high school class who are now in jail? His "brush with the law" will seem much less serious when it is told after stories about people you know who committed serious crimes than it would if he had told it after stories about people who have not committed any crimes. In this example, your hypothetical friend is making his own crime seem less bad by contrasting it with more serious ones. How can you recognize that the same principle of contrast is affecting your judgment in both situations (judgments about pay per hour and seriousness of a crime)? If you can recognize that the same principle is at work, you could use the same critical thinking skills to prevent the effect of contrast from influencing how you think. In other words, how can you learn to apply your knowledge about contrast effects in different sorts of situations?

There is good evidence that when critical thinking is taught for transfer, it will transfer. Here is just one example: Sellier, Scopelliti, and Morewedge (2019) provided college students in France with a serious learning game that was designed to teach players how to recognize and resist three different thinking biases. The biases were (a) confirmation bias (very strong bias to prefer information that conforms to our prior beliefs), (b) multivariate cause–identification (also a strong bias to prefer simple explanations for complex outcomes), and (c) trait hypothesis testing (the belief that people act the way they do primarily because of their personality traits and failure to consider the way the context could be affecting their actions). The authors conducted several sophisticated analyses on their data and concluded that "Debiasing effects of a one-shot training intervention transferred to a novel problem and context in a field setting" (p. 1377). In other words, when they taught in a way that made transfer more likely to occur, the skills transferred to novel problems.

There is an old saying in psychology that "the head remembers what it does." It is important to direct your own learning so that the skills of critical thinking are learned in a way that will facilitate their recall in novel situations. It is what learners do that determines what gets learned. Here are some examples of thinking tasks that are designed to help with the transfer

of critical thinking skills. They require readers to perform certain tasks or answer carefully crafted questions that draw attention to structural aspects of the problem or argument and allow information to be learned at a deep and meaningful level:

- Draw a diagram or other graphic display that organizes the information
- List additional information you would want before answering a question
- Explain why a particular multiple-choice alternative was selected. Which is second best? Why?
- State the problem in at least two ways
- Identify which information is most important. Which information is least important? Why?
- Categorize the findings in a meaningful way
- List multiple solutions for problems
- Identify what is wrong with an assertion that was made in the question
- Present two reasons that support the conclusion and two reasons that do not support the conclusion
- Identify the type of persuasive technique being used
- Present two actions you would take to improve the design of a study that was described.

Tasks like these require learners to focus on structural aspects of the problems so that the learner can identify and use an appropriate critical thinking skill.

Metacognitive Monitoring

Metacognition refers to our knowledge of what we know (or what we know about what we know) and the use of this knowledge to direct further learning activities. When engaging in critical thinking, you will need to monitor your thinking process, check whether progress is being made toward an appropriate goal, ensure accuracy, and make decisions about the use of time and mental effort. Metacognition is the executive or "boss" function that guides how adults use different learning strategies and make decisions about the allocation of limited cognitive resources. Numerous studies have found that good learners and thinkers engage in more metacognitive activities than poor learners and thinkers, and that the skills and attitudes of metacognitive activities can be taught and learned so that students can direct their own learning strategies and make judgments about how much effort to allocate to a cognitive task.

For example, when learners are required to provide reasons and evidence to support a conclusion and counter-reasons and conflicting evidence that refute the conclusion, they must focus on the quality of their thinking. They also have to consider both positive and negative evidence. It is well documented that we tend to weigh evidence much more heavily when it favors a belief that we hold over evidence that disconfirms a personal belief (Lilienfeld et al., 2009).

INTELLIGENCE AND THINKING SKILLS

> The more open-minded and flexible one is, the more rational one will be.
>
> (Barbara Drescher, 2015, para. 5)

One of the most frequently asked questions concerning thinking skills instruction is whether learning to be a critical thinker can make someone more intelligent. Several reviews of the

literature and individual studies (e.g., Moseley et al., 2005), conclude that instruction in critical thinking really can help people think better and that improved thinking will transfer to novel contexts. Can critical thinking improve intelligence? The answer to this important question depends upon how intelligence is defined.

Before you read further, stop for a minute to think about your own definition of intelligence. If a program of instruction can help learners think better, have they become more intelligent?

The Nature of Intelligence

> IQ tests measure only a small set of the thinking abilities that people need.
>
> (Keith E. Stanovich, 2009, p. 3)

Intelligence is one of the most controversial topics in psychology. It is a basic topic in thinking because intelligence is the "stuff" of which thought is made. It is difficult to imagine a context in which intelligence is not manifested or needed. The term intelligence is used commonly in everyday language. Most people believe that they are at least about average or above average in intelligence (Brim, 1966). (Despite Garrison Keillor's assurances to the contrary, you should realize that this is mathematically absurd because most people cannot be above average.)

Psychologists continue to debate exactly what the term "intelligence" *should* mean. Here is a good working definition that was offered by Gottfredson (1997):

> [Intelligence] … involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather it reflects a broader and deeper capability for comprehending our surroundings – 'catching on', 'making sense' of things, or 'figuring out' what to do.
>
> (p. 13)

But intelligence is not the same as critical thinking. There are many highly intelligent people who are not good at critical thinking. They may be deterred by some of the reasons why critical thinking is so hard (covered earlier in this chapter) or they may be superstitious, disdain scientific evidence, or just exhibit cognitive laziness. They may not have the dispositions needed for critical thinking. Butler, Pentoney, and Bong (2017) found that scores on a critical thinking assessment were more predictive of poor decisions made in real life than scores on an intelligence test.

BECOMING A BETTER THINKER: THE QUICK AND EASY WAY

> A sucker is born every minute.
>
> (Generally attributed to P. T. Barnum, but many scholars now believe this quote is from David Hannum who sued Barnum over the use of a phony giant mummy—Mac, 2016, July 15)

As Diane raced through the supermarket after work one day, she was surprised to see a candy bar called "Think!" Just what she needed, a candy bar with "mind enhancing ingredients." And to think (oops, pardon the pun) that she was working hard to learn better thinking skills when all she had to do was eat a candy bar. This "food for thought" can be found on a web page that claims to advertise "natural products and more." Apparently, she is not the only one to wonder about "Think!" candy bars. The Center for Science in the Public Interest, a nonprofit organization, investigated this candy bar (Science in the Public Interest, 2000). They contacted the candy bar company for evidence to back up the claim that the ingredients in Think! can help you "stay sharp." Here's the company's response: "'We're not claiming that it helps you think,' insists Garret Jennings, the inventor of Think!, the 'Food for Thought' bar …. 'But, if somebody feels great after a Think! Bar,' asks Jennings, 'who cares if that is just a placebo effect?'" (p. 12).

We hope that your response to the question posed at the end of the last paragraph is, "I do." A placebo is used as a control or comparison whenever drugs are tested—it is the condition that contains no active drugs—you may know it as a "sugar pill." Sometimes just the belief that we are taking a "drug" that will improve the ability to think can lead us to believe that we really are thinking better, even when we are not. But then, we guess this thinking-candy is targeted at consumers who are not good thinkers in the first place. Of course, it is possible that there are some ingredients that could enhance the ability to think. The question for thoughtful consumers is "What is the evidence that this product does what the manufacturer claims?" According to Science in the Public Interest, the answer is "none."

Unfortunately, there are no quick and easy programs that will make you a better thinker, despite some unscrupulous claims that you can think better instantly, without really trying. A trip through most so-called "health food stores" will reveal a wide variety of products and pseudo-medicines that claim or suggest that they can improve your memory, enhance your thinking, or do whatever else is desirable (e.g., make you thin, sexy, strong, and smart); there is usually little or no valid evidence that any of these products can bring about their promised effects.

THINKING ABOUT THINKING

> You are today where your thoughts have brought you; you will be tomorrow where your thoughts take you.
>
> (James Allen, n.d., Cybernation International; www.cyber-nation.com/victory/quotes..subjects/quotes_thoughtsandthinking.html)

There are many different ways to conceptualize the thinking process. From the perspective of a neuropsychologist or biologist, thinking is the activation of groups of neurons. Other researchers study the medium of thought, the conscious and unconscious use of symbols, images, and words. Another approach is to conceptualize thinking as the flow and transformation of information through a series of stages. But, can our brain reveal its own mysteries? Can we use our brain to think about how we use our brain to think?

THINKING AS IMAGERY AND SILENT SPEECH

> Thinking is the talking of the soul with itself.
>
> (Author unknown—found in a Fortune Cookie)

Psychologists at the beginning of the 20th century believed that thinking was composed of mental images. Later, other psychologists hypothesized that thinking was simply a form of "silent speech," much like talking to yourself without vocalization. In order to test these hypotheses, psychologists would ask subjects to describe what they did when responding to certain questions. Let's try some examples. As you answer each question posed below, try to be aware of what you did as you "thought about it."

1 How many windows are in your living room?
2 What does your mother look like?
3 What letter comes after N in the alphabet?
4 Name a word that rhymes with "shoe."
5 How much is 2 + 3?
6 Can you define "critical thinking?"

As you answered these questions, were you aware of the use of images and/or words? Most people find that when they are asked to describe some concrete object, like the number of windows in their living room or their mother, they are aware of picture-like images. In fact, it seems almost impossible to answer these questions without generating an internal representation or utilizing **imagery** in some way. Can you describe your mother or anyone else without creating an image? Questions like 3 or 4, which involve the order of letters in the alphabet and the sounds of words, usually require an individual to recite the items silently. (Did you sing "l-m-n-o-p" to yourself in order to answer Question 3?) When answering questions like 5 and 6, people are often unable to say how they arrived at an answer. (By the way, if your answer to Question 6 was "no," you should go back and reread the beginning sections in this chapter.) Most people feel that the answers just seemed to "pop into their heads" without their being conscious of the "medium" or "stuff" of thought.

Words serve to direct and stimulate thought. Although it may be obvious that thoughts are usually communicated with language, it is also true that language helps to generate thoughts. The generative role of language can be seen in an experiment by Glucksberg and Weisberg (1966). They used a classic problem in the psychology literature that was originally devised by Duncker (1945). In this problem, subjects are required to attach a candle to a wall so that it could be lit. They are given a candle, a box of matches, and some thumbtacks (see figure 1.2). Stop now and think how you would go about solving this problem if you were given only these materials. Do not go on until you've thought about it.

The best solution is to dump the matches from their box, tack the box to the wall and set the candle in the box. Most subjects have difficulty with this task because they fail to think of the box as part of the solution—they see it only as a "box of matches." Glucksberg and Weisberg had people solve this problem under one of two conditions. The items were either labeled ("box," "tacks," "candle," and "matches") or they were not labeled. Subjects in the labeled condition solved the problem in about one minute, while those in the unlabeled condition

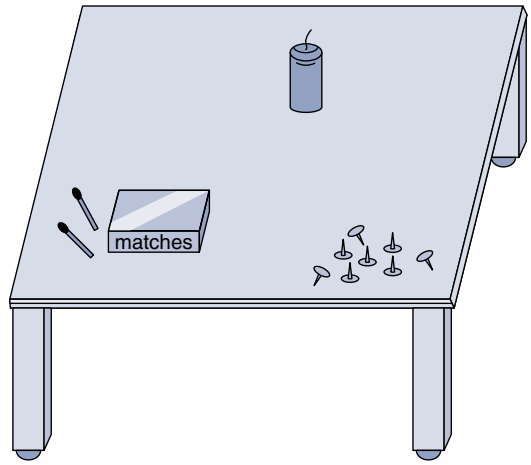

FIGURE 1.2 Using only the materials show in this figure, how would you attach the candle to the wall so that it can be burned?

took an average of nine minutes. The labels directed attention to the relevant items and changed how the subjects in the first group solved this problem. (We return to this problem in Chapter 9, where we discuss problems in problem solving.)

Let's consider a different example of the way language directs thought. There is a popular riddle that goes something like this:

> A young boy and his father went for a Sunday drive. A drunken driver swerved in front of their car, killing the father on impact. The young boy was rushed to the nearest hospital where the chief of neurosurgery was summoned to perform an operation. Upon seeing the boy, the chief of neurosurgery cried out, "I can't operate on him, he's my son!" How is this possible?

When we've posed this riddle to students, they have sometimes replied: "The chief of neurosurgery is the boy's stepfather"; "The real father didn't die"; or "It's impossible." Have you guessed the correct answer? The answer is that the chief of neurosurgery is the boy's mother. The reason for the difficulty is that in our society, when we hear terms like "chief of neurosurgery" we tend to consider only males. The words we use can determine the kinds of thoughts we think. (This concept is developed more fully in Chapter 3.)

BECOMING A BETTER THINKER: A SKILLS APPROACH

Critical thinking skills are those strategies for finding ways to reach a goal. Of course, dividing the thinking process, which is fluid and continuous, into discrete skills is artificial, but it is necessary to break the massive topic of critical thinking into manageable pieces. Although we have divided the topic of critical thinking into several chapters, each of which focuses on a different type of problem (e.g., reasoning, analyzing arguments, testing hypotheses, making decisions, estimating likelihoods), these problems are not easily separable in real life. You will

often need to estimate likelihoods when making a decision or generate possible solutions in a reasoning task. The division is necessary for teaching and learning and is not meant to imply that critical thinking can be cut into neat packages.

The development of critical thinking skills requires specific instruction, practice in a variety of contexts, feedback, and time to develop. We hope that working your way through this book will be mostly enjoyable and well worth all of the effort. An important part of learning is applying the skills of critical thinking to the many different examples that appear throughout the book. To become a critical thinker, you will need to practice, practice, practice. As the old joke goes, it is the only way to get to Carnegie Hall. So, please get comfortable, prepare for some interesting work, and enjoy this book.

CHAPTER SUMMARY

- Although there have always been attempts to get us to believe something that is not true, the internet and social media have made these attempts more prevalent and more pernicious.
- The rapidly accelerating pace of change and wide spread availability of a glut of information and misinformation have made the ability to think critically more important than at any other time in history.
- Critical thinking was defined as the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed.
- It is useful to consider thinking as having two components—a fast or intuitive component known as System 1 and a slower, more deliberate component known as System 2. Critical thinking is System 2 thinking.
- Although many people believe in their powers of intuition, intuitive thinking is more likely to be good thinking when done by an expert who has had repeated experience with feedback in her field of expertise.
- There are many reasons why critical thinking is often difficult—desire is often stronger than critical thinking; we tend to be overconfident about what we know; critical thinking is work and we are often lazy thinkers; people have self-serving biases; thinking is emotional; and many people prefer conspiracy theories in which powerful people work together to accomplish a sinister goal.
- There is considerable empirical evidence from a variety of sources that cognitive skills can be learned from instruction specifically designed to teach these skills and that these skills transfer to real-world settings when they are practiced in multiple contexts.
- Developing a critical thinking attitude and disposition is at least as important as developing the skills of critical thinking. The skills are useless if they are not used. The attitude of a critical thinker must be cultivated and valued.
- The attitude or disposition for critical thinking includes the willingness to plan, flexibility, persistence, the willingness to acknowledge one's errors and change your mind when the evidence supports a change in position, being mindful, and consensus-seeking.
- Metacognition refers to people's knowledge of their own thought processes. We often have little conscious awareness of how we think. Self-monitoring your own thought processes is one way to improve how you think.

- People report that thinking sometimes seems to rely on visual imagery and sentence-like propositions. There are individual differences and task differences in the use of these modes of thought.
- Remember, you are what (and how) you think! Have fun with this book.

CRITICAL THINKING SKILLS

The following skills were presented in this chapter. Review each skill and be sure that you understand how and when to use each one.

- Recognizing the differences between System 1 and System 2 thinking
- Developing the disposition of a critical thinker
- Meta-cognitive monitoring.

TERMS TO KNOW

You should be able to define the following terms and concepts. A good way to review and check your comprehension is to cover up the definition, then try to define each term, then uncover the definition and compare your answer with the brief one that is provided. (Your answer is expected to be more complete than the one presented in this review.) The goal is not to memorize the terms; instead you should be sure that your definition captures the meaning of the term. Be sure to cover the definition because it is easy to believe you know it when the answer is in front of you, but hard to fool yourself when you have to generate your own answer. If you find that you're having difficulty with any term, be sure to reread the section in which it is discussed.

Cognitive Process Instruction. Using our knowledge of how people think and learn with the goal of improving thinking and learning.

Cognitive Reflection Test. A short test to assess the extent to which people use Type 1 thinking when solving selected problems.

Conspiracy Theories. The belief that powerful people worked together to achieve a sinister goal.

Critical Thinking Attitude. The willingness to plan, be flexible in one's thinking, be persistent, to self-correct, maintain mindful attention to the thought process, and seek consensus. It is not possible to be a critical thinker without this sort of attitude.

Critical Thinking. The use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is purposeful, reasonable, and goal directed. Also known as directed thinking. Compare with nondirected thinking.

Habit of Planning. The repeated use of plans until the process becomes automatic.

Imagery. The use of an internal picture-like representation while thinking.

Intelligence. The ability to reason, plan, solve problems, and think abstractly.

Metacognition. Our knowledge about our memory and thought process. Colloquially, what we know about what we know.

Mindfulness. Directing attention to the processes and products of thought.

Nondirected (or automatic) Thinking. Daydreams, night dreams, and rote memorization. Compare with directed (or critical) thinking.

Search-satisficing. The tendency to stop looking for a cause for a problem as soon as one possible cause is identified.

Self-justification. Making excuses for a belief or a behavior instead of considering the possibility that the belief or behavior may be wrong.

Self-regulation. Using feedback, monitoring comprehension, and assessing progress toward a goal.

Self-serving biases. The need to maintains beliefs that are favorable to you.

System 1 Thinking. Type of thinking that is fast and effortless. It is sometimes thought of as intuition.

System 2 Thinking. Type of thinking that is slow and effortful. It informs System 1 Thinking. Critical thinking is System 2 thinking.