

## 2. Clarity and Consistency

**WE SAID** earlier that a worldview consists of a set of statements about the world or some aspect of it. This can mean some part of the physical universe, or the social realm, or the moral world. For example, you probably have developed a worldview of the political system of the United States, of how automobile engines work, and of a million other aspects of our world. Now, focusing just on the worldview itself, we can see that the beliefs in it have to be reasonably clear to be useful. For instance, if you say “The rich don’t give my kind respect,” this is unclear, and thus of little use in, say, predicting how you are going to be treated by people you meet. What does “respect” mean in this regard? And what people count as your “kind”? On the other hand, the statement “Any object released near the surface of the Earth in a vacuum will fall with an acceleration of 32 feet/second” is admirably clear, at least to those educated enough to understand the sentence, and hence much more useful as a tool in explaining and predicting how objects will behave if (say) dropped off a cliff.

So clarity is obviously desirable in a worldview. Perhaps less obvious is the need for consistency. A group of statements is **consistent** if and only if the statements *can* all be true at the same time. Note that we are not saying that all the statements in the group *are* true. A group of statements is thus **inconsistent** if and only if the statements *cannot* all be true at the same time. Now, how might an inconsistency make a belief system be less useful as a tool?

Consider the following belief system, consisting of my beliefs about dogs:

1. All dogs are unfriendly.
2. Mandy is the dog who lives next door.
3. Mandy is friendly.

Suppose that I have little experience with dogs, and that statements 1 to 3 comprise all I know or believe about dogs. My belief system is obviously inconsistent: statements 1 and 2 together imply that Mandy should be unfriendly, but statement 3 contradicts this conclusion. As I walk up to Mandy, what should I expect? My worldview doesn’t help me decide, precisely because it is inconsistent.

Clarity and consistency, being features of a useful worldview, are essential features of critical thinking.



### THOUGHT QUESTION

Besides inconsistency between statements, there is another form of inconsistency. When you say someone is a “hypocrite” you are accusing them of being inconsistent in a different way. Can you define that second sort of inconsistency?

## 3. Relevance

**THE QUALITY** of relevance can be introduced only after we talk about questions a bit. We said that we modify our worldviews in part by questioning other people and nature, and we apply our worldviews to new situations by questioning our worldviews or accessing the information in them. But a major requirement of the logic of questions is **relevance**, the requirement that the information collected be related or appropriate to the issue at hand.

Consider an example: suppose you are trying to learn more about dog behavior because you are going to be a mail carrier. You are trying to expand your worldview regarding the canine world. Some key questions you will want to research are these: In what situations do dogs become aggressive? Which breeds of dogs are most inclined to attack? How dangerous are dog attacks, anyway? You decide to go to the library and research these issues.

Clearly, the following books would be irrelevant:

*Everything You Ever Wanted to Know about Cats but Were Afraid to Ask*  
*The Way of All Waterfowl*  
*Crime and Punishment*

Possibly relevant would be these titles:

*Breeds of Dogs*  
*Dogs—The Barking Killers*  
*How to Keep Your Dog Happy*

I say “possibly relevant” because determining what precisely is relevant is sometimes tricky: a book such as the last one on keeping a dog happy is relevant to the issue of aggression in dogs if but only if we assume happy dogs are nonaggressive. Background information plays a role in determining relevance.

Critical thinking, then, involves the skill of framing pertinent questions and seeking answers relevant to the question at hand.

#### 4. Justification and Explanatory/Predictive Power

**WE WANT** our worldview models to be reliable and useful. But suppose my belief system about dogs rests solely on what my Uncle Ray has told me about them, and Ray has little knowledge of dogs. My canine belief system would not be reliable at all. Now, if my belief system were based on extensive library research, extensive conversations with numerous dog breeders and veterinarians, and also my personal experiences with numerous dogs, my belief system would be much more reliable, because my beliefs would be much better justified.

Being justified in believing a statement involves having evidence for it. Logicians use the term ‘argument’ to refer to a statement together with the justification for it. An **argument** is a set of one or more statements, called the **premises**, taken as evidence for another statement, called the conclusion. An **inference** is a conclusion reached on the basis of evidence and reasoning. The logic of inference/argument is thus a useful tool in determining whether beliefs are justified.

Justification is important to the reliability of a belief system. But in addition to being reliable, we want our worldviews to be useful—they are tools after all. A worldview is practically useful if it helps you explain and understand the world around you and if it allows you to predict and control events in the world around you. Succinctly put, we want our belief systems to have explanatory and predictive power.

Perhaps the best examples of predictive and explanatory power come from the history of science. Louis Pasteur, for example, proved to skeptical people the existence of microbes and their role in causing disease. People’s mental models of disease were made greatly more useful—we now understand how infections arise, and we can predict and to some extent control infectious disease accordingly.

## IMPORTANT THINKER

## Louis Pasteur

Louis Pasteur (1822–1895) is popularly known as the “father of microbiology.” He is certainly one of the early major exponents of the “germ theory” of disease, and one of the main founders of bacteriology.

Pasteur was born into a poor family in 1822. But he managed to get a good education, and in 1848 was appointed professor of chemistry at the *École Normale Supérieure*. In 1887, he established the Pasteur Institute, and he was director there until his death.

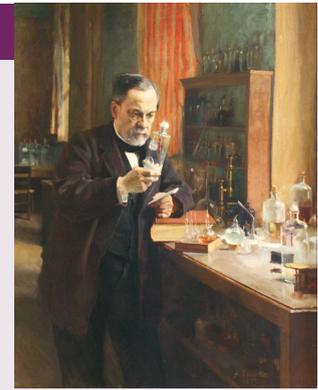
Pasteur did seminal work on properties of tartrates—the tiny crystals that sometimes appear in wine. But his renown rests upon his work in microbiology and the germ theory of disease. He demonstrated that yeast is responsible for fermentation of sugar into alcohol. He also showed that microbes are responsible for spoiling beverages, and devised a heating process (called to

this day ‘pasteurization’) for treating liquids such as milk and beer to keep them fresher longer. He also devised a way to kill germs on surgical instruments, and convinced doctors to

wash their hands before touching patients, greatly reducing death rates in hospital operations.

Pasteur was also crucial in discrediting the theory of spontaneous generation, which held life forms from decaying matter. He showed that all microbes come into being from prior microbes.

He also received acclaim for his work on vaccination, especially his development of a vaccine against the dread diseases rabies and anthrax.



*Louis Pasteur in His Laboratory*

Prediction and explanation, like justification, involve the logic of inference. So again, logic is crucial to critical thinking, since it helps us make useful mental models.

## 5. The Usefulness of Critical Thinking

**BEFORE EMBARKING** on our tour of critical thinking, we ought to reflect a bit about the usefulness of what we are about to learn.

I suppose the easiest way to see the value of critical thinking is to point out just how much deceit and humbug surround us. The most obvious area of deceit is the consumer realm. We are bombarded constantly with misleading and illogical ads and sales pitches, in junk mail, on the TV, in the internet, over the phone, at the front door—everywhere. Someone is always trying to sell us something and will say anything to get the sale. We constantly pass laws to ensure truth in advertising and stop consumer fraud, but the tricksters can create new scams faster than lawmakers can outlaw them. There is no substitute for having a critical mind when deciding how to spend money.

Also obvious is the amount of deceit in the realm of politics. Many, if not most, politicians and political spokespeople use rhetorical tricks to win elections or get their policies adopted. Even assuming that political sophistry is done either out of ignorance or out of good intentions (politicians often argue that “you can’t do good unless you are first elected”), it is clear from the history of the twentieth century that tremendous harm has resulted when people are duped by persuasive politicians.

Perhaps you are thinking that I have picked too easy a target to make my case: salespeople and politicians. But we needn’t stop there. In the general realm of science, for example, we often

encounter bunkum—pseudo-science, as it is often called. People have claimed any number of bizarre things—that apricot pits can cure cancer, that people have been abducted by aliens, that the Earth is flat, that ground-up rhinoceros horns, when eaten, can enhance your sex life—the list is endless. Moreover, such lack of critical thinking is not merely confined to the fringes of science. Mainstream scientists are not immune from the same types of bad reasoning as the rest of us are guilty of, as Robert Youngson (1998) amply illustrates in his book *Scientific Blunders: A Brief History of How Wrong Scientists Can Sometimes Be*.

Even in the realm of religion, we need critical thought. Bizarre cults abound, with devotees checking their critical faculties at the door. We only notice them when they make the news (such as the cult in Jonestown, or the Koresh followers in Waco, or the terrorists who let loose poison gas in the Tokyo subway), but cults are ever with us.

## NOTORIOUS EVENT

### Jonestown

A classic illustration of the dangerous things a cult can induce its members to do is that of the Jonestown tragedy.

Reverend Jim Jones (1931-1978) was born and grew up poor in Indiana. People who were acquainted with him as a child described him as very strange, and obsessed with death and religion. Even when young he studied Gandhi, Hitler, Mao, Marx, and Stalin.

In 1951, Jones started attending local communist party meetings and became a devout Marxist. He decided to “infiltrate” the church, and after being a student pastor in the Methodist Church, he launched his own church, ultimately called the People’s Temple Christian Church Full Gospel. By the 1970s, Jones was articulating his own faith—or ideology—that the Bible is a tool of repression of women and people of color. He preached that he was the reincarnation of the Buddha, Gandhi, Jesus, and Lenin. His wife said in a 1977 interview that her husband was using his religion to promote Marxism, and that Mao was his role model.

In the early 1970s, Jones had moved his church to California, eventually establishing its headquarters in San Francisco, then a hotbed of radical political movements. But a major published exposé of his People’s Temple in 1977 revealed numerous cases of physical, emotional, and sexual abuse. This led Jones to move his organization to a site he had set up in the South American country of Guyana—a site he named “Jonestown.”



AP Photo/FILE

Jones presented Jonestown as a model for communistic society. Citing the Soviet Union, Communist China, Cuba, and North Korea as models, he did not permit members to defect. Ominously, he began preaching a doctrine called “Transition,” which held that he and his followers would die together and move on to another world.

These dreams ended in nightmare. In 1978, an investigating commission visited Jonestown, but left quickly (with some cult defectors) after a knife attack by a cult member. Arriving at the airport, Jones’s armed guards started shooting, killing five members of the investigating commission.

Later that day, Jones had convinced his 909 followers to prepare a Kool-Aid type mixture with sedatives and cyanide in it. The parents had their children drink it first, then the adults poisoned themselves. All of them died. Jones committed suicide with a pistol.

The story survives in our national memory as slang: we say of someone who uncritically accepts a political or religious ideology that he or she “has really drunk the Kool-Aid.”



### THOUGHT QUESTION

An important feature of human life is ethical judgment: we often judge other people's actions, characters, and values. How does critical thinking influence ethical reasoning?

## 6. Impediments to Critical Thinking

**WE VIEW** critical thinking in its broadest sense as the development of ever more accurate worldview or reality models, and the use of those in decision-making. This involves improving one's cognitive skills and acquiring new knowledge. But we should be honest here and recognize that the process of improving critical thinking faces several major hurdles or impediments; I will characterize these as individual impediments, interpersonal impediments, and social impediments.

Individual impediments to improving one's mental model are systematic problems people have in reasoning and learning. Cognitive psychologists and behavioral economists have called

### IMPORTANT THINKER

#### Vivien Thomas

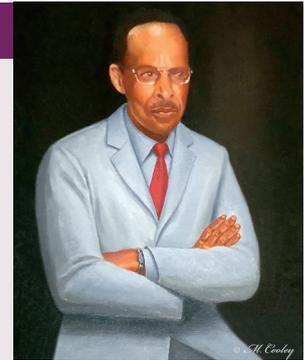
Vivien Theodore Thomas (1910–1985) was born in New Iberia, Louisiana, the grandson of an enslaved person. His plans to attend medical school were ended by the Great Depression; instead, he took a job as a surgical research assistant for the noted surgeon Dr. Alfred Blalock at Vanderbilt Medical School. Within weeks, Thomas was beginning surgery on his own—in effect, doing the work of a postdoctoral researcher, but being paid as a janitor. When the local banks where Blalock and Thomas had their savings failed, Thomas abandoned plans for medical school and held on to his relatively secure job. Blalock taught him surgical techniques. In 1941, Thomas worked as a partner with Blalock in developing path-breaking heart surgery.

In 1943, Blalock and Thomas began researching “blue baby syndrome.” The procedure they developed was published in 1945 and within a year more than 200 other children were successfully operated on. But nowhere in the widespread press coverage were Thomas's substantial contributions ever noted. And despite his extraordinary talent as a surgeon and the fact that he routinely taught to other surgeons the heart surgery technique he had developed in 1946, again, he received no recognition and little pay. Thomas frequently had to work

as a bartender—often at Blalock's own house parties—to make ends meet.

While the relationship between Blalock and Thomas lasted 34 years, it grew increasingly strained, due in great measure to Blalock's refusal to give Thomas official credit or interact with him outside their work. When Blalock died in 1964, Johns Hopkins Medical School kept Thomas on as director of surgical Research Laboratories, despite the fact he was never able to go to medical school. In 1976, Johns Hopkins University awarded Thomas an honorary doctorate, and he was finally appointed to the School of Medicine as Instructor of Surgery. Twenty years after his death in 1985, the Johns Hopkins School of Medicine named its four new colleges after famous Johns Hopkins faculty, one of whom was Vivien Thomas.

In 2004, HBO made a movie of Thomas's life—*Something the Lord Made*—which won both Emmy and Peabody Awards. Modern heart surgery would not be possible without Thomas's contributions.



these “cognitive biases.” To get some idea of what this concept encompasses, let’s briefly mention four of the most pervasive of such biases.

Perhaps the greatest such cognitive bias is called “confirmation bias.” **Confirmation bias** is the tendency selectively to seek out or remember information that supports one’s pre-existing beliefs or pet theories, and to downplay evidence against them. In scholarly research, “data-mining” is extracting useful information from vast amounts of raw data; this process is abused when researchers come up with a new theory or idea, and spend all their time searching through the existing literature for material that supports that thesis.



### THOUGHT QUESTION

How do search engines and social media increase confirmation bias?

A second pervasive systematic flaw in reasoning is “self-serving bias.” **Self-serving bias** involves claiming more responsibility for one’s successes than for one’s failures. If I choose to buy a stock and it rises in value, I will view myself as being shrewd. But if it drops in value, I will say that there were factors beyond my control that made it drop in value.

A third major bias is **hindsight bias**, which is the tendency to see past events as being predictable. It is easy to “predict” past events when you already know what happened. A history student, for example, studying the period just before World War II broke out, might argue that the US leadership should have foreseen that Pearl Harbor would be attacked when it was.

The fourth common cognitive bias is “fundamental attribution error.” The **fundamental attribution error** is the inclination of people to invoke personality-based, rather than situational-based, explanations for other peoples’ beliefs and actions. So, for example, when something bad happens to someone else, one is likely to attribute that to personal defects on the part of the victim; but when something bad happens to one’s self, one tends to blame the situation.

Cognitive psychologists have identified literally dozens of other such biases.

Besides our individual tendencies toward error, we can be manipulated by others. These interpersonal impediments to critical thinking will be the focus of Chapters 17 and 18 (on product marketing and political propaganda). The problem here is that certain **psychological mechanisms** tend to lead to mistaken conclusions and counter-productive actions.

For example, people tend to reciprocate—return favors for favors. These tendencies are generally socially useful, but *can* be used by other people—especially people trained in exploiting these mechanisms—to manipulate us. An advertiser might, for example, send a dollar bill with a mailer soliciting donations to a charity. The advertiser is doing this because a fair percentage of recipients of the mailer will donate out of a sense of wanting to return kindness for (apparent) kindness.

Finally, by **social impediments** I mean the limitations of our communities. Our reality models in great part derive from what we learn from others. Knowledge—especially scientific knowledge—is produced within communities. And a person’s worldview can be limited or skewed by the particular beliefs of his/her culture. This point we will explore in Chapters 11 through 15.

## 7. Critical Thinking as an Academic Discipline

**IN MY** view, critical thinking as an academic discipline is a fascinating hybrid discipline that combines elements of traditional deductive logic (especially informal fallacies and the theory of definition), the logic of questions (erotetic logic), inductive logic (statistics, especially game/decision theory and statistical sampling), rhetoric/communication studies (especially recent

## IMPORTANT THINKER

**Hypatia**

Hypatia (c. 360–415 CE) is the earliest prominent female mathematician and was highly regarded also as a philosopher, astronomer, and teacher.

Hypatia was crucial in sustaining and propagating the Greek tradition of skeptical inquiry and the love of learning and discovery. She is known to have written commentaries on great Greek mathematical works.

Hypatia's demise was—like Socrates—driven in part by intellectual issues and in part by local politics. A non-believer in the rising doctrine of Christianity, she nevertheless was very tolerant of Christians and taught a large number of them.

But this ecumenism was to lead to Hypatia's demise. She became an advisor to the Roman prefect of Alexandria, Orestes. But Orestes was fighting with the Bishop of Alexandria, Cyril. When rumors spread among Cyril's followers that she was an obstacle to peace between Orestes and Cyril, a mob of monks murdered her.

Hypatia's martyrdom, like that of Socrates, has been the subject of various historical



*Hypatia Teaching at Alexandria*

interpretations. After her death at the hands of Christian monks, Neoplatonic pagans used her as a symbol of resistance to Christianity. But in the Middle Ages she became a paragon of Christian virtue: she was seen as chaste, devoted to worldly peace, and a promoter of fraternal love among everyone. In the Enlightenment era, she was taken as the symbol of opposition to Catholicism. More contemporary thinkers see her as a symbol of the struggle for women's rights and as a proto-feminist.

argumentation theory), cognitive science (especially cognitive psychology), economics, and legal studies, all to study that mental process. I have tried to utilize tools from each of these disciplines as appropriate in studying how we reason and how we can improve our reasoning in ordinary life.

Specifically, in my treatment of argument identification I use rhetoric and informal logic. In my treatment of clarity, I use definition theory (as is traditional) but also conceptual maps (from AI). In my treatment of consistency, I use truth tables and Venn diagrams (from deductive logic). In my treatment of relevance, I use the logic of questions. In my treatment of observation and memory I exploit recent research in cognitive psychology. In my treatment of testimony, I utilize work in legal studies. In my treatment of generalization, I focus on statistical polling techniques. In my treatment of causal inference I focus on the statistical methods used in drug research. In my discussion of rational decision-making, I utilize the traditional economic model, but discuss recent behavioral economic research as well. And in my discussion of sales tactics and political trickery, I utilize the recent research in the psychology of compliance.

## 8. *The Organization of This Book*

**THE ENSUING** chapters of this book elaborate the concepts I have briefly sketched here. In the first part, we look at the elements of critical thinking. A worldview is a set of beliefs in various statements, so in Chapter 2 we discuss the nature of statements in detail. We create, modify, and use our worldviews by asking questions and drawing inferences (constructing arguments). Accordingly, Chapter 3 discusses questions—their structure and how to answer them appropriately. In Chapters 4 and 5, we define arguments, considering what forms they have and how to identify them in practice.

Chapters 2 through 5 thus involve preliminaries—key definitions and skills concerning sentences, statements, questions, and arguments.

In the second part of this book, we look at the goals of critical thinking. Chapters 6 through 15 develop the skills necessary to achieve clarity, consistency, relevance, justification, and explanatory/predictive power in our thinking. Chapters 6 and 7 deal with clarity: we discuss which pitfalls of language give rise to obscurity, and what logical tools can be employed to help achieve clarity. In Chapter 8, we discuss relevance at length; in particular, we examine the ways in which people fail to bring relevant information to bear on the issue at hand in a discussion. In Chapters 9 and 10, we learn the basics of deductive logic, which is a tool for achieving both consistency and justification.

Chapters 11 through 15 explore inductive logic, the chief tool in exploring justification and explanatory/predictive power. We look at observation and testimony in Chapter 11. In Chapter 12 we discuss generalization and case reasoning—that is, the application of general beliefs to particular cases. We learn about analogical reasoning in Chapter 13, and Chapter 14 covers reasoning about cause and effect. Chapter 15 describes hypothesis and explanation.

The third part of the book invites us to apply the tools we have learned to the world around us. Chapter 16 presents a simple model for decision-making. We use this model in Chapter 17 to look at consumer choice and in Chapter 18 to help understand political choice. Chapter 19 looks at critical thinking when it comes to discerning pseudo-science.

You should note a few things. First, all even-numbered items in the Problem Sets you will encounter are answered on the companion website. Second, every major technical term is printed in bold print when it is defined; moreover, these terms with definitions are collected in the Glossary.

### *Review Questions for Chapter 1*

1. What is a worldview?
2. What is critical thinking as a reasoning process?
3. What is critical thinking as an academic discipline?
4. Identify the criteria for an effective worldview.
5. What is a fallacy?
6. What does it mean to say a group of statements is consistent?
7. What is relevance as a requirement on information collected?

# Concept Map of Chapter 1

