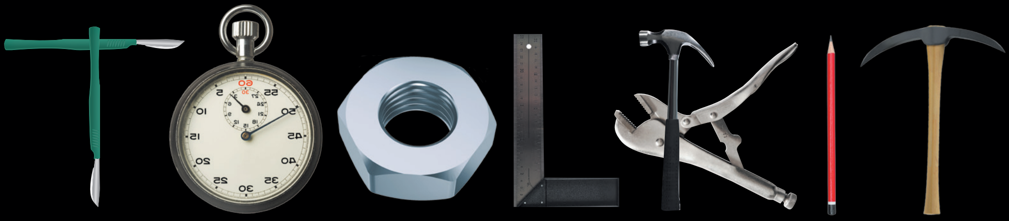
Galen A. Foresman, Peter S. Fosl,
and Jamie Carlin Watson

The CRITICAL THINKING TOOLKIT



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TOOLKIT

GALEN A. FORESMAN, PETER S. FOSL, AND JAMIE C. WATSON

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To our students and to the Logos

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Introduction

The Very Idea of Critical Thinking

Critical thinking sometimes seems as if it needs an apology, or rather it seems itself to be a kind of apology, an apology for the humanities and the liberal arts and sciences generally. Having failed to convince many people that the liberal arts are simply good in themselves or in their own terms, academics sometimes seem as though they have concocted the meretricious idea of "critical thinking" in order to help higher education sell itself to the worlds of commerce, law, and politics. Instead of arguing that the liberal arts comprise some of the very best ways to spend a human life, period (and that we ought, therefore, to support them enthusiastically and share them as widely as possible), academics seem inclined to wave the flag of critical thinking to convince governments, parents, students, and donors that the liberal arts offer something that's "useful" or "profitable" in the "real" world.

Critical thinking also seems to appeal to administrators and the administratively inclined because it poses as something testable, as composed of skills that produce "measurable outcomes" readily subject to "metrics" and "assessment." Yielding measurable, quantifiable outcomes is important not only for demonstrating to those outside the academy the value of critical thinking and the liberal arts but also for "accountability," for oversight, for ranking and managing, and perhaps for policing liberal arts faculties.

There is truth in all this, embarrassingly so. But it's not the whole story about critical thinking (or the liberal arts), not by a long shot. The authors of this book are convinced that the family of practices collected under the rubric of "critical thinking" does indeed include some of the best and most important activities human beings have forged and re-forged, shaped and refined over the last three millennia. It's not too much to say, in our view, that critical thinking distills some of the very best of that inheritance. In the development of our sciences, our political institutions, and our very self-understandings, critical thinking has played a central role, and it's simply

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fine and good to pass on that treasure to future generations. What has been true of our history remains true today: strong critical thinking is not only useful for commerce, the law, and technology, it's absolutely crucial to a dynamic and thriving culture, and it defines an essential component of any solid education.

But what is critical thinking? What composes it? In this volume, we've taken a broad, interdisciplinary, and relatively comprehensive approach to critical thinking. While many critical thinking texts focus almost exclusively on logical topics, we've also compiled critical insights and practices that have been cultivated by the natural and social sciences, notably psychology, by literature and literary criticism as well as by the fine arts, and by political and social theories. We treat literature, rhetoric, and the arts not simply as obstructions or distractions that get in the way of clear, analytical, and logical thinking – though they sometimes can do that. We recognize in addition that the visual, literary, and generally rhetorical arts possess distinctive tools to enhance and deepen critical thinking. While the critical tools developed by philosophers, logicians, mathematicians, and empirical scientists are extremely important to good critical thinking, the critical instruments honed by theorists in literary, political, and social theory have been profound. No account of the possible methods of critical thinking available today would be respectable or even roughly complete without them. Arguments are, indeed, terribly important, but they're not by any means the whole story of critical thinking. We encourage readers, therefore, to take a similarly broad, interdisciplinary, and inclusive approach and to consider the diverse ways critical thinking has been cultivated across the spectrum of reflective human thought.

Critical thinking in the formal and empirical sciences

Considering the structure of this book, we begin with logic, since logic is basic and essential to critical thinking. Chapters 1–4 of this ten-chapter volume are accordingly devoted to explaining some of the most important critical tools logicians have crafted, especially for the practices of what they call *deductive* reasoning. These techniques can seem a bit daunting to beginners, but because logic is so important we encourage you to press on through them. Logicians have studied the *formal* qualities of deductive inferences over thousands of years, and they've produced several logical systems that critical thinkers can use to test arguments. Those tests are not only indispensable tools for critical thinking. They also share the virtue of producing definite answers about good and bad reasoning using procedures that are clear, reliable, and not terribly difficult to use.

The oldest of these systems we'll address (Chapter 3) was systematized first by Aristotle in fourth-century BCE Greece. It's come to be called *categorical logic* since it's a logic that's based upon categories of things. We'll map out seven tests for the validity of arguments using categorical logic. Those seven by themselves will provide critical thinkers with a rich and powerful set of tools to interpret and assess vast regions of human reasoning.

Yes, humans seem to possess a natural capacity for recognizing good reasoning even without studying critical thinking in a formal way, but the systems we present are important to master because they make it possible for skilled critical thinkers to build on that natural capacity and employ proven and useful rules in expansive ways – including articulating proper explanations and definitions, determining logical equivalences, and identifying contraries and contradictions, as well as a variety of other logical relationships. We'll explain and demonstrate the use of helpful pictographic tests using Venn diagrams and Gensler stars, and after setting out some basic logical theory we'll show you how to apply a number of simple procedures for reliably identifying valid and invalid arguments almost in a snap.

The second principal kind of formal logic we'll address (Chapter 4) has come to be called *propositional* or *sentential logic* – because, yes, it's the logic of propositions or whole sentences. These sections will present you with additional ways to test arguments, especially through what logicians call truth tables, common forms of valid argument, and tried-and-true rules of inference. Truth tables are attractive to people because they offer a graphical way of testing arguments, and one that's simplicity is perhaps even more exhaustive and direct than Venn diagrams. Learning the formal structures of the most common valid as well as invalid arguments together with what we think is an essential collection of other inference rules will help you sharpen the focus of your reasoning detectors so that the success or failure of arguments becomes much more easily recognizable.

Chapter 5 sets out a substantial list of some of the most common ways people go wrong in their daily reasoning. These common *informal fallacies* aren't failures of the formal or structural dimensions of arguments (the stuff of Chapters 3–4), but rather failures of another kind. Sometimes what goes wrong in reasoning isn't a matter of argument form at all but instead often involves psychological factors that yield quasi-inferences that pose as good reasoning but simply aren't. Sometimes, alternatively, the problem lies with the underlying concepts and assumptions behind a claim. Those concepts and assumptions can be irrelevant, confused, or simply false, and as we'll see they can really mess up your reasoning. Good critical thinking skills of the sort described in Chapter 5 have been designed to detect them, and there are many of them. Because some informal fallacies are particularly related to scientific thinking, we'll broach additional informal fallacies across the remaining text, especially in those chapters devoted more directly to inductive reasoning and the empirical sciences.

There are sadly, then, a lot of ways that reasoning can go wrong. The modern natural and social sciences were born from a struggle to deal with many of these kinds of error while simultaneously trying both to understand the world and to answer the philosophical challenge of *skepticism* – the idea that knowledge itself might not be possible. As a result of those challenges, scientists and philosophers of science developed important ideas regarding what counts in terms of empirical inquiry as good *explanation* and solid *justification*. We'll therefore examine what makes scientific forms of inquiry so strong, and we'll also look at how science can go wrong. Chapters 6–9 will draw lessons in critical thinking from the natural and social sciences as well as from ongoing philosophical confrontations with skepticism. We'll examine how best to confront the epistemological challenges of skepticism, how to think well and critically about causal explanations and statistical claims, how to enlist scientific principles critically, how to think critically even about science itself, and we'll consider what science has learned about why human beings make errors. Critical thinkers should certainly be able to assess non-scientific claims using scientific rationality, but they should also possess some facility with assessing scientific claims themselves.

Critical thinking, critical theory, and critical politics

Human beings are linguistic beings. We communicate, reason, and criticize using language, and the critical theories developed by scholars in fields related to rhetoric, languages, and literature have gone a long way toward explaining not only how communication works but also how it fails to work – that is, how language and our human modes of expression themselves create, even require, the possibility of error, confusion, and misunderstanding. The meanings we wish to express are difficult to express. They're elusive and fragile and complicated. We all know this on some level, but critical thinkers must become especially sensitive to it. Narratives, poetic tropes, voice, and other rhetorical dimensions of texts, however, not only offer opportunities for error and distortion. They also yield indispensable ways of understanding our selves and our world. Chapter 10 is designed therefore to help you consider critically the rhetorical and semiotic dimensions of the world in whatever text you confront – and not just in a theoretical way. Like our other chapters, Chapter 10 offers examples and problems for you to use in putting these tools to work.

Human practices of expression are also tied up with political relations. We are, as Aristotle observed, political animals. Moreover, political theorists, especially across the past few centuries, have come to understand that politics doesn't only exist in the halls of government, in voting booths, on explicitly political Internet web sites, or on clearly political TV or radio talk shows. Politics is, rather, pervasive and infuses our ordinary language, our concepts, our conduct, indeed the very institutions that compose our societies and cultures broadly speaking. Engaging political as well as moral topics critically, therefore, may involve not only thought but also action.

Political action may be a matter of subversion and destabilization, of prising open spaces for new ways of life, and deconstructing what we determine needs to change. It may also, however, be about justifying and stabilizing values, principles, and moral claims – those that already exist and we think it important to keep, to protect, and to secure. In order for readers to engage their own political world more effectively, in addition to questions related to justification and values in Chapters 6–9 we also lay out tools drawn from political theory in Chapter 10. We don't presume the political theories we describe to exhaust the field of political thought, and we don't necessarily endorse them ourselves, but we do think these are among the most important critical approaches today, and it's necessary for able critical thinkers to gain some facility with them.

Strong critical thinkers, in sum, should be able not only to wield the tools of logic and science but also those that illuminate the complexities of language and communication as well as those that help confront, advance, or resist the principal forms of morality and politics at work in the world today. Critical thinking should not only be directed toward improved inquiry into questions of truth and falsehood but also into issues of meaning more generally as well as imperatives and possibilities of moral and political action.

Critical thinking, finitude, and self-understanding

There's something else. We wish to make it clear that critical thinking, like our book as a whole, is about self-understanding. It's part of that ancient project enshrined in the inscription on the temple at Delphi and in the liberal arts and sciences: "know thyself." Using critical thinking we produce critiques not just of arguments, data sets, propositions, and texts in the abstract. We also produce critiques that reveal our limits, our weaknesses, our finitude, and our selves as we actually exist in the world. Thinking about the world, about others, and about ourselves in light of a reflective and critical self-understanding of the human condition may be even more important than winning arguments or unreflectively accumulating facts, wealth, or power. It may, indeed, be the most important critical thinking outcome of all.

Using this book

This volume is not a complete text in logic, cognitive psychology, epistemology, critical theory, or political and social theory. The world of ideas is vast. We have collected what we think are the essentials for a basic grasp of critical thinking, and we have compressed, so far as possible, our entries to provide you with substantial and sophisticated but also concise accounts of the tools we address. You may read the text sequentially since it follows an arc from the positive establishment of claims through the complexities of logical and scientific thinking and reasoning to, finally, a critical *denouement* in rhetoric and politics. But the text may be read in other ways, too. You may start anywhere and either follow your own muses or fork off onto the network of paths we recommend using the suggested "See also" pointers at the close of most entries and chapters.

You will often see us referring in the body of the text to the preceding toolkits in this series: *The Philosopher's Toolkit* and *The Ethics Toolkit*. That's because we understand these books to work together synergistically with ours, and they often offer entries that complement and enrich our own. Some of the entries of this volume overlap with entries in those other toolkits (and we are grateful to Julian Baggini for permission to do that), and so together we think they offer a kind of functional whole of critical and philosophical thinking. But this volume stands on its own, too, very much so; and it offers readers a fine gateway all its own to these powerful, critical tools.

Our book also contains larders of examples and problems for study and exercise. These may be enlisted by instructors in their class preparation or simply by readers for further reflection. As we've not always provided answers to these problems and questions, they're as much matters of provocation as instruction. A list of web sites at the end of the volume suggests additional resources relevant to critical thinking freely available on the Internet.

Know thyself and think critically.

1 Basic Tools for Critical Thinking about Arguments

1.1 Claims

"Listen to reason!" cried Charlotte, exasperated after an hour of argument with Charles. And Charlotte's frustration may have been perfectly justified. What is reason? And why should we listen to it? Most basically, reasoning is about advancing *truth claims* by means of special *logical* procedures of *argument* (see 1.2). One of the most basic elements of critical thinking, then, especially when engaged with issues related to logic and science, is to discern whether claims are actually true and to distinguish them from claims that are not true.

In practice, language is our most fundamental tool in this process. Language allows us to articulate what we judge to be true or false, and it allows us to share and communicate those judgments to others. Ultimately, a good critical thinker must develop an acute grasp of language in order to make clear and precise claims about the truth and to assess how well or badly they function in the logic of an argument. Logicians have technical names for the kind of sentences out of which logical arguments are built. They call them *statements* or *propositions*, and they're simply sentences that can be either true or false (in logical terms, they possess a *truth value*). To really understand statements and their truth values, however, keep the following in mind.

- *Bivalence*. Statements or propositions can *only* have one truth value, and it must only be either true or false. Moreover, statements or propositions can't be both true and false in the same sense under the same circumstances. Logicians call this the principle *the law of bivalence*. (To be sure, there are multi-valued logics with values besides true and false, but again they're the subject of a different, more advanced book.)
- *Excluded middle*. There's no middle ground or gray area between truth values in basic logic – no "truthiness" as the comedian Steven Colbert might say. Statements or propositions can't be "sort of true" and "sort of false." Logicians call this

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requirement the *law of excluded middle*. (Yep, there are *fuzzy logics* that accept gray areas, but we won't be dealing with them here.)

- *Non-statements and propositions*. Keep in mind, too, that sentences that aren't (in logic's technical sense) statements or propositions simply don't have truth value. Neither questions ("Where are you going?") nor commands ("Stop that!") nor exclamations ("Wow!!!") are properly speaking true or false; and so they can't be proper parts of arguments, logically understood.

Now, the idea of a *claim*, in the sense we use the term here, adds for the sake of critical thinking just a bit more to what logicians strictly call statements and propositions. In particular, *claims* are statements that indicate a position has been taken. A claim, in other words, is a statement or proposition that in some meaningful sense sincerely belongs to whomever or whatever asserts it. One of the first judgments a good critical thinker must make, then, is to determine in just what way a statement is presented. Perhaps it's meant sincerely and seriously, but perhaps it's just being used hypothetically, ironically, as a joke, an instructive example, a lie, or perhaps in the recitation of some movie script. Or maybe it is simply being used to provoke an audience, to gain attention, to test someone's response, or perhaps for some other reason entirely. There are countless things one can do with words and other forms of expression. So, while most of the material in this and the next four chapters applies to all claims, and not just to statements or propositions, we will use the language of "claims" to keep the question of claim or non-claim in mind.

Here's the upshot. Since it's often the case that critical thinking involves discerning truth and error, a good critical thinker must learn how to identify claims that are true, or most likely seem true, while at the same time recognizing and avoiding claims that are best judged false. What's more, a good critical thinker will recognize and admit when he or she does not know whether a claim is true or false. Critical thinking sometimes requires reserving judgment as to whether or not a claim is true until, if ever, sufficient reason for determining the truth or falsity of that claim is discovered.

Beliefs and opinions

In the 1989 comedy film, *The Big Lebowski*, a competitor scheduled to face the main character, the Dude, in the next round of a bowling tournament declares that his team is going to crush the Dude's. The Dude, at least pretending to be unfazed, responds, now famously, by remarking, "Well, that's just your opinion, man." It's not uncommon for people to distinguish strong truth claims from those that are weaker by calling the weaker claims opinions. People often make claims such as, "The world is round," implying it's something we definitely *know* to be true, that it's a *fact*. When, on the other hand, people make claims such as, "Pele was a better athlete than Gretzky," we deflate the claim by saying that it's just their "opinion."

Beliefs can obviously often be either true or false, but a misleading though nevertheless common misunderstanding about the difference between strong assertions (such as knowledge claims) and mere opinions is that opinions aren't really true or false. As such, they're often thought to be free from the same scrutiny and justification required by claims to *know*. The result of this mistaken view is that many people believe that one's opinions are somehow insulated from dispute or challenge. Opinions are treated as if they stand alone as islands in our thoughts, entirely disconnected from criticism and critical thinking. In reality, however, our opinions are still very much claims open to criticism. They are, after all, claims, and therefore either true or false. (Matters concerned with knowing are described as *epistemic*, and *epistemology* is the study of knowledge. Matters concerned with belief we'll sometimes call *doxastic*.)

In addition, it's important to understand that opinions are often influenced by what we value. This mixing of beliefs and values sometimes makes it difficult or confusing to assess their truth. But a good critical thinker's toolkit provides the tools for tackling this seemingly tricky task (see 5.5, 7.2, 8.2, and 8.5). In the meantime, just keep in mind that opinions often incorporate judgments and emotions about what is valuable, either subjectively, to the person expressing the opinion, or objectively, to everyone in the world.

Simple and complex claims

A *simple* claim is a claim that, logically speaking, isn't divisible into other, more basic claims. This is usually a single subject-predicate formula, for example, "It is a cat," or "That ball is round." A *complex* or *compound* claim is a claim logically composed of two or more claims (or, minimally, a single claim that's negated) connected by special words or ideas logicians call *logical operators* or *connectives*. (Of course, not all devices to connect one sentence with another do so as a matter of logic – as any poet or lyricist will tell you.)

Simple claims, as some logicians have observed, are kind of like atoms, while complex claims are kind of like molecules. The claim that "Earth exists" is a simple claim. If, however, we add to the claim that the Earth exists another claim, "Humans live on Earth," then we will have created the complex or molecular claim: "Earth exists, and humans live on it." Notice that a complex claim may be expressed in lots of ways, and yet still be composed of the same simple claims:

Humans live on Earth, and Earth exists.
Humans live on Earth, which exists.
Earth exists, and humans live on Earth.

Sometimes, two sentences, whether simple or complex, can be said to possess the same *meaning*. Having the "same meaning" can, however, mean a variety of things. In this context, let's just say that sentences having the same meaning can be used interchangeably, and one reason for this may be that the claims have the same *cognitive* or *material content*. (Another reason, as we'll discover in the next three chapters, may be that they have the same *formal* qualities, which means they have the same logical structure.) The cognitive or material content of most claims determines the conditions that make those claims true or false – or what logicians call the *truth conditions*. In other words, the claim that the Earth exists is true if and only if the Earth really exists. The Earth's existing is the condition that must be met in order for the claim "Earth exists" to be true.

The truth conditions of complex claims, however, are a bit more, well, complex than those of simple claims. The truth conditions of complex claims are determined not only by the simple claims from which they are constructed but also by the *logical operators* or *connectives* used to combine the simple claims and sometimes other properties of the complex. Common logical operators are "and," "or," "if," "if and only if," and "not." (The last of these, "not," is unique and extremely powerful. It's not used to combine multiple simple claims, but rather to change the truth value of a claim, whether simple or complex, to its opposite value. If true, a negated claim becomes false; if false, a negated claim becomes true.)

Earth exists.	simple claim
Earth does not exist.	negation (not)
Earth exists, and humans live on it.	conjunction (and)
Earth exists, or humans live on it.	disjunction (or)
Earth exists, if humans live on it.	conditional (if)
Earth exists, if and only if humans live on it.	biconditional (if and only if)

Of course, each of these claims has a different meaning, and those meanings are derived from the cognitive content of the simple claims – "Earth exists" and "Humans live on it" – as well as from the logical operators that are used to combine or modify those simple claims.

Here's a tricky bit. It's important to remember that despite the number of simple claims composing a complex claim, a complex claim can be viewed as one, big single claim. That's because a complex claim is, as a whole, either true or false, just like a simple claim. The simple claims "Earth exists" and "Martians exist" have truth values (the first is true and the second, we presume, is false). But combine them into a complex claim using a connective and the result has its own truth value: the claim "Earth exists *and* Martians exist" is false; the claim "Earth exists *or* Martians exist" is true. You will see exactly why in Chapter 4. For now, just be aware that complex claims are single if not simple claims, and that each has its own single truth value.

Truth functionality

Here's something even a little trickier. The truth value of different kinds of complex claims must be determined in different ways. For some complex claims, the truth or falsehood of the whole is *completely* determined in a logical sense just by the truth values of the component claims that compose it as well as by the way they relate to one another – that is, by (1) the simple claims plus (2) the logical operators that connect and modify them. For other kinds of claims, you can only determine the truth value of the whole claim by considering other features of the claim and perhaps only the claim as a whole.

When the truth or falsehood of the whole is *fully* determined by the truth values of its component simple claims plus their logical relations (the first type), we call the claim a *truth function* or say that the sentence is *truth functional*. There are lots of other simple and complex statements and claims, however (the second type), that don't possess this property. Belief statements, for example, are not truth functional. So, the truth value of the sentence, "Oedipus believes that the husband of Jocasta is not the killer of Laius," does not, tragically for Oedipus, depend upon the truth or falsehood of its component simple claim, "the husband of Jocasta is the killer of Laius." Unfortunately, whether or not we believe a statement is often independent of whether or not it's true. (The distinction between truth functions and non-truth functions may seem a bit arcane at this point, but truth functionality will become especially important later, and we'll elaborate on the concept a bit more when we address propositional logics in Chapter 4.)

SEE ALSO

4.1 Propositional vs. Categorical Logics
8.1 Knowledge: The Basics
9.5 Unfalsifiability and Falsification Resistance

READING

Patrick J. Hurley, *A Concise Introduction to Logic*, 12th edn (2015), Sections 1.1, 2.2, 6.2
Julian Baggini & Peter S. Fosl, *The Philosopher's Toolkit* (2010), Chapters 1–3
Anthony Weston, *A Rulebook for Arguments*, 4th edn (2009), I.1
J. van Benthem, *A Manual of Intensional Logic* (1988), Part I

1.2 Arguments

A well-known Monty Python skit presents two men at an "Argument Clinic," a client and a "professional" arguer. The fun begins when the professional arguer simply contradicts everything the client says ("Yes, I did." "No, you didn't." "Yes, I did." and so on.). Shrewdly, the client isn't impressed: "Look this isn't an argument … It's just contradiction." Okay, so what *does* count as an argument?

For critical thinkers, the term "argument" means something very specific. Briefly put, an *argument* is a special tool that systematically collects and arranges reasons in support of the truth of a claim. As the client of Monty Python's Argument Clinic puts it, "An argument's a collected series of statements to establish a definite proposition!" A bit more specifically, arguments are simply sets of claims in which one or more claims are to provide support or justification or proof for the truth of another claim.

Essential to every argument, then, are at least two components: (1) a single *conclusion* and (2) at least one reason or *premise* for the conclusion to be true. Identifying which is which in a given case can sometimes be confusing, though. That premises are intended somehow to support or seem to support a conclusion indicates that a third element is present in logical argument – (3) an *inference* from the premise(s) to the conclusion. It's in the quality of that inference where things get especially interesting for critical thinkers, as not all inferences are good or strong or legitimate.

Logic vs. eristics

It's common for people to confuse verbal altercations with arguments, since commonly, the term "argument" refers only to a dispute between two or more people, any kind of dispute. It's also common for people to confuse *eristics* (the study of *winning disputes*) with *logic* (the study of *reasoning*). Arguments, however, in the technical, *logical* sense discussed here do not require a dispute, disagreement, or even dialogue, and they certainly don't involve yelling, screaming, fisticuffs, or kerfuffles of any other sort. Furthermore, *debates* are also commonly confused with arguments because they are typically composed of many arguments, and the opposing sides of a debate offer arguments in support of the claims they wish to establish. So, debates include argument, but you needn't have a debate to argue.

Arguments vs. explanations

Moreover, not all sets of sentences that lead to statements claimed to be true are arguments. For that reason, often a critical thinker will find himself or herself trying to determine whether or not a set of claims is, in fact, an argument. For example, *explanations* often seem like arguments. But there is deep difference between the two. Explanations are sets of claims that function to establish *how* or *why* something is the case. Arguments, in contrast, undertake to establish *that* some claim, normally a claim in question, is actually true. It's very different, for example, to explain *how* extraterrestrials have made their way to Earth from arguing *that* extraterrestrials have made their way to Earth – though both might involve presenting a flying saucer.

Arguments show that *something is the case.*
Explanations show how *or* why *something is the case.*

Explanations are easily mistaken for arguments because in many respects the two share stylistic similarities. Much like an argument, an explanation will include a single claim upon which all the other claims bear. In an explanation, this claim is called an