

# Introduction

What you are holding in your hands is an introduction to Critical Thinking. This discipline regards two related areas: first, the set of skills and competences that help you recognize, evaluate and produce *good* arguments; second, the set of activities and tools that we can call on and use to train these skills, respectively. This being so, why is the subject called “Critical Thinking”?

In ancient Greece, the term “*kriticós*” meant the ability to judge and discern things, in order to make the best choices for ourselves and others. These days, this ability appears to be struggling to survive. In the world of hyper-communication, monopolized by social media, it happens that our ability to judge the opinions of others, to tell truth and falsity apart, to distinguish good reasons from bad reasons in support of a choice, has been weakened almost to the point of disappearing. We all know why. The inflated amount of information showering us every day makes it very hard to tell what is reliable and relevant from what is not. This phenomenon is just made worse by the proliferation of *fake news*, that is to say by the deliberate dissemination of false information that leverages widespread prejudices plus our fears, thus managing to attract the attention of the public. In addition, today any exchange of views, both on the social media and in public discussion, tends to turn into a relentless struggle, in which the insult, the denigration of the opponent, or the ridiculing of the opinion of others, often takes the place of critical discussion of the reasons supporting a given claim. All this drastically reduces not only the quality of public debate and collective choices, but also our ability to express a well-considered judgment on issues that are often very relevant to our lives.

It is therefore no coincidence that today the graduation programs of many of the most important universities in the world include a Critical Thinking course: it aims at sharpening the students’ ability to adequately justify a claim, to refute the claims of others, to identify mistakes in reasoning, and to evaluate the reasons in support of a certain assertion. This applies both to everyday discourse and scientific inquiry.

The goal in question can only be achieved, however, by adopting an interdisciplinary approach. There is a vast spectrum of disciplines from which one can draw in this respect: logic, probability theory, statistics, decision theory, and again the theory of argumentation and the theory of rational discussion, as well as disciplines which study language, first of all pragmatics. An important contribution to a full awareness of the problems and skills that come into play in Critical Thinking is al-

so provided by cognitive psychology, and in particular the psychology of reasoning and the psychology of decision. The ability to produce and evaluate arguments, in fact, depends not just on the rules that govern rational discussion, but also on our ability to guard against cognitive biases that systematically lead us into error in making a choice or in providing a solution to a problem. More in general, the ability in question depends on our ability to avoid fallacies, that is, patterns of reasoning that do not work, and yet we tend to follow them for some reason. These mistakes are due to how *real cognitive agents* are made – to our difficulties in using some reasoning patterns; or to the fact that the cognitive fatigue that we would experience in following correct reasoning procedures leads us to adopt “shortcuts” that can lead us to wrong conclusions.

One important point of Critical Thinking is that, in teaching us to evaluate an argument, it does not take *the way in which we actually tend to think* as a criterion. Instead, it assumes a set of *normative standards* by which *we must* reason, *if* we want to be *rational*, as is desirable. Indeed, the Critical Thinking approach considers reasoning from a normative point of view, not from a *descriptive* one. It is worth noticing that we ourselves recognize the normative prescriptions on reasoning as rational once we are told where our mistakes are, as we will see in Chapter 1. We will see, in any case, that a normative approach to reasoning can only really be illuminating if we are aware of how we *actually* reason. Thanks to cognitive psychology, today we can achieve this (at least, to a much greater degree than in the past).

Being aware of the various aspects that condition the reliability of the judgments in each field of knowledge will help the student to acquire the critical and anti-dogmatic spirit that distinguishes a good university education. Moreover, learning to think critically is fundamental today for anyone wishing to make thoughtful choices in the field of public life and to avoid the temptation to believe that the opinion of those who shout the loudest, or receive the most likes, is necessarily the best option. In this sense, the path proposed in these pages is aimed not only at university students, but at anyone who has the desire to learn to think better and discover the weaknesses of other people’s reasoning.

## Contents and structure of the volume

This book is an introduction to Critical Thinking, which first focuses on its logical aspects, showing at the same time the intersection of logic with the study of cognitive biases and also with the characteristics of the argumentative processes that have a place in everyday life, without neglecting an introduction to the basic tools for probabilistic and statistical reasoning. The path proposed in the book is divided into three parts.

In the first part (Chapters 1-4) we will focus on what a *good* argument is, and we will explore the function that the evaluation and exchange of good arguments

play in our rational activities. We will do this after having given a context in which we can frame the activity of evaluating and producing good arguments. More specifically, Chapter 1 will deal in detail with the distinction between *normative approaches* and *descriptive approaches* to reasoning, allowing us to understand that there are standards of *rationality* that, for a variety of reasons, we do not always follow. Chapter 2 will focus more specifically on what *arguments* and *good arguments* are, thereby elucidating two concepts that we will use throughout the rest of the volume. The second – that of a good argument – is the key concept of this work. We will see, in the same chapter, that there are different forms of reasoning. Chapter 3 will set arguments and their features in a precise context, that of discussion, and in particular rational exchanges of views, and will address a phenomenon that always occurs in the most interesting discussions, namely disagreement. Indeed, it is the presence of disagreement which solicits the elaboration of arguments. We will give an overview of the different reactions to disagreement, concluding with the most rational one. Chapter 4 will analyze the latter in detail, illustrating the different strategies we can use to concretely realize that.

This first part offers a fundamental set of notions that constitute the common thread of the volume, and provides a general framework that helps us understand why we should take interest in reasoning, and that reasoning is fundamental in many applicative disciplines and in many concrete areas of our lives.

In the second part (Chapters 5-7) we will discuss deductive arguments, which are one of the most solid and best regimented tools of our reasoning activities. Chapter 5 presents an overview of the reasoning tools provided by propositional (or “sentential”) logic and quantified (or “predicate”) logic. It also shows concrete strategies for checking whether an argument is deductively valid or not (these notions will be introduced in Chapter 2). Chapter 6 and Chapter 7 delve into two specific cases of deductive reasoning: reasoning with indicative conditionals, and reasoning with counterfactuals. The reason for dealing with them is that they are both central to our reasoning activities. Chapter 6 focuses mainly on a particular type of indicative conditional that logicians refer to as a “material conditional”, but it also discusses the possibility of other indicative conditionals.

That is the most technical part of the volume, even if the material has been conceived and written to be accessible to an audience with no background in logic or mathematics. The technical aspects are explained step by step, keeping notation and formal considerations to a minimum.

In the third part (Chapters 8-11) we will discuss non-deductive arguments. However solid deductive reasoning is, it does not, in fact, prove particularly useful or illuminating in some contexts, especially those in which we try to explain facts by formulating *hypotheses*, or where we have to reason about *statistical projections* or *probabilities*, or in contexts in which our reasoning must be conducted on the basis of *analogies*. Chapter 8 deals with reasoning using explanatory hypotheses, and discusses a specific case: reasoning with causal hypotheses. Chapter 9 deals with sta-

tistical reasoning – both with *statistical generalization* and with the *application of statistics* to specific cases. Chapter 10 deals with probabilistic reasoning. It is the most technical chapter of the third part, but the formal and mathematical considerations are still kept to a minimum. Finally, Chapter 11 deals with reasoning by analogy, which plays a considerable role in legal and moral reasoning.

This last part is more discursive than the second, as we have favored conceptual understanding over technical discussion (keep in mind, however, what we have just said about Chapter 10). This is because there are a great many formal approaches to the various types of non-deductive reasoning, while there is much more uniformity as regards deductive reasoning. Since this is an introduction to Critical Thinking, we have favored the presentation and understanding of the basic aspects over a technical study that could branch out in many directions, with the risk of going far beyond the didactic purposes that the book sets out to achieve.

Although the discussion follows a unitary line of development, the various chapters lend themselves to being read and used separately, according to the needs of the readers and their desire for further study.

It is not entirely possible to fully understand, evaluate and produce good arguments if we do not familiarize ourselves with the “other side of the coin”, that is, with those reasoning patterns that seem to work but in reality systematically lead us to erroneous conclusions. This is one of the reasons why we discuss *cognitive biases* in Chapter 1. Furthermore, we discuss some fallacies where these seemed most relevant. Chapter 4, Chapters 6-7 and Chapter 10 discuss specific fallacies and errors of reasoning in the corresponding areas of reasoning covered by the chapter.

The volume tries to follow a precise methodology of presentation: we start out from examples as far as possible and use these to illustrate the general and conceptual points we face. We believe that a bottom-up treatment is more suitable for addressing specific problems than a top-down one, which favors the systematic presentation of theory and general considerations over case studies. However, we have tried to ensure that the exemplifications do not diminish the attention paid to those general and abstract aspects that are necessary for the conceptual understanding of reasoning and of the problems connected to it.

## A terminological note

Some of the terminological choices we made in writing this volume might sound misleading to the reader who is already familiar with philosophy or the theory of argumentation, or with the theory of reasoning in general. We therefore believe that it is appropriate to discuss them briefly.

Throughout the volume we will talk about *sentences* rather than *propositions*. We will say that sentences appear in reasoning and that sentences have truth-values. An important philosophical tradition, however, has it that propositions do this. What is the

difference? From a technical point of view, a sentence is a syntactic entity that (i) satisfies some rules of grammar (or is “well formed”, as logicians say), and that (ii) if uttered in the indicative mood asserts something. “La neve è bianca” is a sentence in the Italian language. “Snow is white” is a sentence in the English language. “Umberto Eco” is *not* a sentence, but a name – if I utter this string of sounds I am not asserting something, just pronouncing a couple of words. Since the identity criterion for sentences is their syntactic make-up, “La neve è bianca” and “Snow is white” are different sentences. Instead, a *proposition* is the *content* of a sentence. But there is some disagreement as to what a proposition is, in turn. For some philosophers, a proposition is the thought expressed by a sentence; for others, it is (ideally) the set of scenarios that make a given sentence true. Be that as it may, both views agree in saying one crucial thing about propositions, as the example shows: “La neve è bianca” and “Snow is white” are different sentences that express the *same* proposition. More generally, we could say that propositions are “interpreted sentences”, that is, the result of the association of a content (be it a thought or a set of scenarios) to a string of signs having certain characteristics. From this point of view, it is perfectly justified to say that it is the propositions that are true or false. In fact, it is by virtue of “interpretation”, in the sense just illustrated, that they are true or false. And it is perfectly justified to say that reasoning is made up of propositions. Reasonings are mental acts (acts that involve certain entities: the arguments), and therefore involve sentences that we always *think of*, or, in a broader sense, that we “interpret”, in the sense illustrated.

However, we believe that relaxing the terminology and saying that a sentence has a truth-value will do no harm. In fact, given *one* particular interpretation of it, a sentence can be associated with truth-values *by transfer*, on the basis of the truth or falsity of the proposition which that given interpretation associates with it. If so, we can also, for the sake of convenience, take the sentences to be constituent parts of arguments and reasonings, when, as in this volume, the main interest is in the truth of the premises and the conclusion, and of their logical relationships. Indeed, these relationships can be faithfully transferred from propositions to sentences.

Let us therefore take this terminological liberty, in the awareness there are certainly grounds for suggesting that the other choice would be more rigorous. One reason we were prompted to proceed in this way is that, given the disagreement on what a proposition is, it is easier and more intuitive to explain and understand what a sentence is. In any case, our choice is applied consistently throughout the book.

Another clarification: in this volume we talk about *arguments*, *reasoning*, and *inferences*. We will see in Chapter 2 what an argument is. Technically, reasoning is the act – carried out by any cognitive agent – of *thinking about* a topic, that is, of carrying it out in thought; in this sense, reasoning is a *mental act*. However, in history and even in current usage, the term “reasoning” is almost always used in a looser sense, and in such a way that it is in fact interchangeable with the term “argument”. We will do the same throughout this volume. This choice will do no harm: as you will notice when reading the text, nothing we say when talking about “reasoning” will depend on its specific nature as a mental act – everything will instead

depend on the “structural” characteristics that reasoning “inherits” from the relative argument. We will therefore speak, for example, of the validity or invalidity of an instance of reasoning (or an argument), and of the structure of an instance of reasoning (or an argument). Finally, inference is the act of concluding a sentence (or proposition) from a series of other sentences (or propositions) in a reasoning. From a technical point of view, therefore, it is another mental act. However, in this case too, the use of the term is usually looser. In this volume, we will talk about inference whenever we are in the presence of the particular application of an argumentation scheme that leads us from some premises to a conclusion, regardless of whether the premises and conclusion are thought of or not, and whether the act of passing from the premises to the conclusion is actually accomplished. Consistently with this choice, we will use “inference scheme”, “reasoning scheme”, and “argumentation scheme” as synonyms.

## Origin and attribution of the chapters

It is important to point out that this book is the result of a collective work. We started thinking about it in 2018, when the first Critical Thinking course was given at Bocconi, at the initiative of Rector Gianmario Verona. The course is still taught to a considerable number of classes, which required the collaboration of several teachers and authors. In the first phase, each chapter was assigned to a specific author; subsequently, the chapters were substantially reworked by Roberto Ciuni and Aldo Frigerio, and then revised by Damiano Canale and Giovanni Tuzet.

The initial versions of the chapters are attributable as follows: Chap. 1, Giovanni Tuzet; Chap. 2, Damiano Canale; Chaps. 3-4, Ciro De Florio and Aldo Frigerio; Chap. 5, Roberto Ciuni and Aldo Frigerio; Chap. 6, Massimiliano Carrara; Chap. 7, Vittorio Morato; Chap. 8, Roberto Ciuni and Giovanni Tuzet; Chap. 9, Aldo Frigerio; Chap. 10, Daniele Chiffi; Chap. 11, Aldo Frigerio and Giovanni Tuzet.

The final versions published in this book can be attributed as follows:

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- Chapters 3-4, Roberto Ciuni, Ciro De Florio, Aldo Frigerio;
- Chapter 5, Roberto Ciuni, Aldo Frigerio;
- Chapter 6, Massimiliano Carrara, Roberto Ciuni, Aldo Frigerio;
- Chapter 7, Roberto Ciuni, Aldo Frigerio, Vittorio Morato;
- Chapter 8, Roberto Ciuni, Aldo Frigerio, Giovanni Tuzet;
- Chapter 9, Roberto Ciuni, Aldo Frigerio;
- Chapter 10, Daniele Chiffi, Roberto Ciuni, Aldo Frigerio;
- Chapter 11, Roberto Ciuni, Aldo Frigerio, Giovanni Tuzet.

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