

Robert Ciesla

The Book of Chatbots

From ELIZA to ChatGPT

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 Springer

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Preface

This book is for anyone interested in chatbots and artificial intelligence (AI). Its purpose is to serve any layperson as an introduction to some rather fantastic topics. AI truly is an unstoppable, world-changing set of technologies and my humble wish as an author is for everyone to start paying attention to it—right now.

We'll begin our journey into the world of chatbots with some pertinent historical developments in the field. For one, we'll review some of the monumental work of *Alan Turing OBE FRS (1912–1954)*. Turing put many foundations of today's digital technology in place.

Chapter 2 will have us exploring the most important concepts behind AI. We'll also take a solid gander at things like *the internet of things (IoT)*, the now-ubiquitous network consisting of smart-home appliances like phones, cameras, and even some refrigerators. In addition, the second chapter explains the basics of linguistics and how an AI processes human languages.

Chapter 3 is all about a trio of historical chatbots: *ELIZA*, *PARRY*, and *Jabberwacky*. While primitive by today's standards, these three programs represent important stepping stones in chatbot development.

In Chap. 4 we'll get acquainted with modern chatbots, including OpenAI's mighty ChatGPT and Google's Bard. A number of chatbots for productivity-related tasks have also been released in recent years, so we'll also explore how these tools can be used for helping us in our daily lives.

The focus of Chap. 5 is medical chatbots. We'll go through the main ways they assist in medicine in numerous ways, ranging from appointment scheduling to emotional support.

Chapter 6 takes us to the busy world of chatbots in eCommerce, where they are fast becoming a must-have for businesses of any size. We'll go through some basics of how AI is being leveraged in marketing and customer service.

While AI is generally a force for productive purposes, it has a destructive side; this will be the topic of discussion in Chap. 7. We'll go through the more seedy uses of chatbots and AI in this chapter, examining things like AI-powered plagiarism (i.e. aigiarism), malware, and deepfakes (i.e. realistic faked videos).

Chapter 8 is all about *Artificial General Intelligence (AGI)*, also known as *strong AI*. This refers to an as-of-yet theoretical type of autonomously functioning artificial entities capable of passing as human beings. AGI represents the apex of AI development, but it also introduces many ethical challenges. We'll review some of the most important academic papers in this field in this last chapter.

The chatbots have arrived. Eventually, the technology behind them will be implemented in new, awe-inspiring ways and on a much bigger scale. This book will hopefully raise awareness of both the opportunities and issues inherent to AI.

Helsinki, Finland
10 October 2023

Robert Ciesla

About the Author

Robert Ciesla is an author, composer, and programmer from Helsinki, Finland. He has a BA in Journalism from the Haaga-Helia University of Applied Sciences, an MA in Culture Studies from the University of Helsinki, and an Advanced Diploma in Computing from the University of Oxford. Robert likes rainy days and long hikes in nearly any terrain. He has previously written the following five books for Apress/Springer Nature:

- Sound and Music for Games (2022)
- Programming Basics: Getting Started with Java, C#, and Python (2021)
- Encryption for Organizations and Individuals (2020)
- Game Development with Ren'Py (2019)
- Mostly Codeless Game Development (2017)

Robert's favorite chatbot is Dr. Sbaitso. His personal website is at robertciesla.com

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Chapter 1

The Challenge of the Turing Test



1.1 Introductory Small Talk

E: Hello, I am Eliza.

R: Good day to you!

E: We were discussing you, not me.

R: Indeed. I need help.

E: Can you elaborate on that?

R: I'm writing a book on chatbots.

E: How long have you been writing a book on chatbots?

R: For about two weeks now.

E: Say, do you have any psychological problems?*An actual conversation with ELIZA, an early chatbot from the 1960s.*

As you enter the world of chatbots it's helpful to understand some of the associated basic terminology and history. This chapter will introduce some fundamental concepts and early developments in the field of artificial intelligence. We will mostly focus on the work of accomplished mathematicians Alan Turing and Kurt Gödel, whose discoveries remain very important in the field.

1.2 On Chatbots and the Arrival of Artificial Intelligence

Some of the earliest pondering on artificial intelligence took place in ancient Greek; *Talos* was a mythical boulder-lobbing artificial guardian for the inhabitants of Crete. More practical approaches in computing took a long time to emerge, speeding up in the nineteenth century. In 1801, a French inventor by the name of *Joseph Jacquard* created a semi-automated looming machine which used wooden cards to "program" its designs. In 1821 English mathematician *Charles Babbage* unveiled his plans for

a steam-powered calculator, the *Difference Engine*. He later designed the *Analytical Engine*, a general-purpose computer. At this point conversational software was out of our reach.

During the first boom of developments on artificial intelligence in the 1940s, the world did not have the luxury of computing power we take for granted now. Much of the work still remained abstract, yet many important foundations were put in place. Things like the *Turing Test* (discussed later in this chapter) emerged during an era where black and white cathode-ray tube televisions represented the apex of home electronics. The microchip hadn't happened. The Internet with its machine learning applications was barely touched in science-fiction at the time. In 2023 and beyond, your smart devices represent an ubiquitous form of computing which not only tracks your whereabouts (sometimes with your consent) but increasingly leverages advanced algorithmic AI. You may have conversed with *Apple's Siri* or *Amazon's Alexa*. Recommendation algorithms used by *Youtube* and *Netflix* constantly learn about your viewing habits—and so on.

Note: An algorithm is basically a set of rules which solve a problem.

The whole world is terminally online and there are very few compelling reasons to drop the habit. In us having the Internet, the pros far outweigh the cons. Current-era artificial intelligence is a collective process in which everyone is a contributor. Data is being stored and analyzed constantly even in the most trivial of interactions, such as browsing the net. Like with any powerful new technology, AI has both positive and negative ramifications. Unlike early chatbots, solutions like *ChatGPT* are no longer confined to the realm of entertainment and scientific curiosity. Modern AI and chatbots are gaining leverage in the world of technology, arts, and academia. As all those online customer service bots demonstrate, chatbots do not need actual sentience to serve a useful purpose to us. The world would change in an instant should actual machine sentience arrive and perhaps do so beyond our wildest dreams. In March 2023 CEO of SpaceX and Tesla *Elon Musk*, Apple's co-founder *Steve Wozniak*, and many others created a petition to halt the research on AI for at least 6 months due to “profound risks to humanity and society” (Future of Life Institute, 2023). What probably scares us most isn't artificial intelligence in itself and its potential nefarious uses—deep down we may simply fear its autonomy.

1.3 Alan Turing, OBE, FRS: Pioneer, Mathematician, Cryptographer

Any discussion on artificial intelligence and its applications would be incomplete without exploring the work of mathematician and computer scientist *Alan Turing* (1912–1954). He pioneered several seminal concepts in the field and made a profound effect on the development of modern computers. Having graduated Princeton University in 1938 with a doctorate in mathematics, Turing went on to provide invaluable cryptographic assistance to the allied forces during World War 2. His

codebreaking device, the *Bombe*, managed to decipher encrypted messages broadcasted by Nazi Germany's *Enigma-machine*. Enigma's follow up, the *Lorenz*, was in turn defeated by *Colossus*, a codebreaker which utilized many of Turing's principles. Some experts, like *Alan Hodges* and *Hugh Sebag-Montefiore*, argued these developments had the effect of cutting the duration of World War 2 by up to 4 years. Turing and his colleagues worked at *Bletchley Park*, a mansion and estate in Bletchley, Milton Keynes, in the United Kingdom. It housed the primary centre of the Allied codebreaking effort during World War 2.

After the war Turing worked on the *Automatic Computing Engine (ACE)*, the first complete computer design. The ACE was released, against Turing's wishes, in a simplified and smaller form in 1950 as the *Pilot ACE*. It later evolved into *MOSAIC (Ministry of Supply Automatic Integrator and Computer)*, a device dedicated for calculating aircraft trajectories from radar data. Hardly a compact computer, MOSAIC occupied several rooms. It continued to operate into the 1960s.

For his efforts during the war Turing was given the *Order of the British Empire (OBE)*, the nation's highest honor. He was also awarded the *Fellowship of the Royal Society (FRS)* in 1951 for his outstanding achievements in science. Alan Mathison Turing died of cyanide poisoning in 1954.

1.4 The Turing Machine

First made public in 1936, *Turing Machines* are abstract devices which help us conceptualize the possibilities of what computers can process. A basic Turing Machine operates with the following three components:

1. **An infinitely long tape divided into slots.** Each slot contains either 1, 0, or remains empty (see Fig. 1.1). The modern equivalent for this tape is a computer's RAM or Random Access Memory (or its storage i.e. a hard drive). All modern computing is still executed on a fundamental level in binary code (i.e. zeroes and ones).
2. **A tape-head.** This component can read the data in the aforementioned slots. It can move left or right and fill them with 1 or 0. The head may also erase data.
3. **Instructions/state register.** The register contains the instructions for the head, i.e. it stores the sequence of events the head is going to execute.

Fig. 1.1 The basic layout of a Turing Machine

