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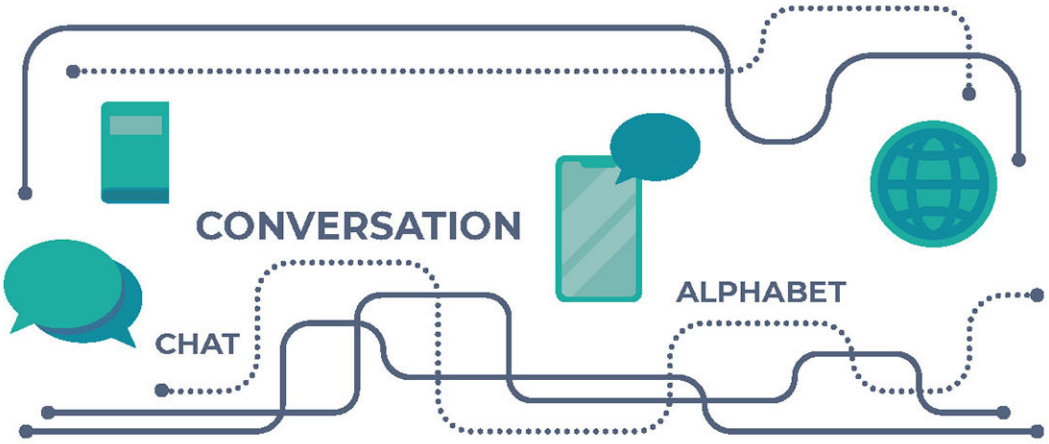
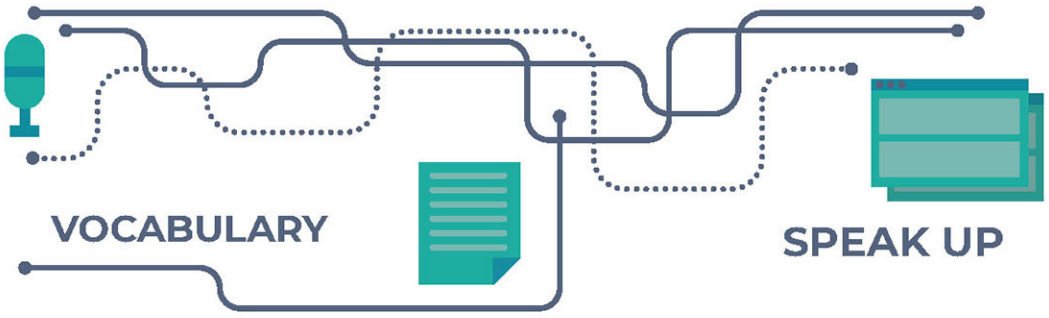



# ARTIFICIAL KNOWLEDGE OF LANGUAGE

## A Linguist's Perspective on Its Nature, Origins and Use

Edited by
**José-Luis Mendívil-Giró**

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SERIES IN LANGUAGE AND LINGUISTICS

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*Although Markov, Turing, von Neumann, or Chomsky never got a Nobel Prize, technologists developing their foundational ideas into Large Language Models surprisingly did: in 2024. The present book delves into the (for now) state-of-the-art in this saga, presenting it as dispassionately as possible through eight prismatic chapters. If readers wonder how momentous an epilogue and beyond can be, they only need to imagine the offspring of a next generation of such devices - albeit built beyond classical presuppositions in hardware, logic, or even modeling. The latter no longer seems like a chimerical possibility; whether that is for better or for worse, surviving the future may tell.*

**Dr. Juan Uriagereka**
Professor, Linguistics & SLLC
University of Maryland

*A comprehensive and wide-ranging overview of the issues (and non-issues) raised for linguistic theory, particularly Chomskyan linguistic theory, by the development of Large Language Models. The editor's introduction is particularly useful. Highly recommended for linguists, including computational linguists, of all persuasions, as well as computer scientists, philosophers and psychologists with an interest in language and AI.*

**Dr. Ian Roberts**
Professor of Linguistics
University of Cambridge

David J. Lobina
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# Table of Contents

# List of figures

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# List of tables

# Preface

The objective of this volume is to gather linguistically informed opinions (from linguists or cognitive scientists with specialization in the study of language) on the nature, origins and use of the knowledge of language developed by the Artificial Intelligence systems called Large Language Models (LLMs).

The recent development and popularization of these systems has had a significant impact on the media, particularly the most well-known and widely used system, ChatGPT (developed by the company OpenAI). Similarly, this emergence has led to the proliferation of opinions regarding the relevance of LLMs beyond the practical (and typically commercial) purposes for which they have been designed, particularly in the fields of cognitive science and linguistic theory. Thus, it is not uncommon to find on social networks, blogs and popular magazines statements such as that LLMs have solved the problems that sciences such as linguistics aim to solve, that the success of LLMs in the generation of text can be considered a refutation of some notably influential theories of language (especially Noam Chomsky's approach and generative grammar, the tradition that arose from his ideas about language and the human mind), or the claim that LLMs are in fact scientific theories of language.

These statements appear to be founded upon the premise that the linguistic knowledge acquired by these systems is analogous to, or at least comparable to, that which is developed by human beings in a naturalistic manner. The objective of this book is to evaluate the extent to which this assumption is justified.

It is important to recall that Noam Chomsky, in his 1986 book *Knowledge of Language: Its Nature, Origins, and Use* (whose title serves as inspiration for that of the present volume), argued that the pivotal shift in the science of language that emerged with generative grammar and the so-called cognitive revolution in the 1950s was the realization that the object of linguistic inquiry, as part of the broader field of natural science, was not the observable linguistic behavior of speakers or the product of their language use, as was previously assumed, but rather the knowledge of language itself.

Consequently, the questions that the chapters gathered in this volume aim to answer, all of them related to the central issue of comparing natural and artificial knowledge of language, are the following:

- To what extent are LLMs models of human language?
- To what extent can it be asserted that, for example, ChatGPT has learned English (or any other language)?
- What, if any, are the differences between the knowledge of language possessed by LLMs and that of human beings?
- In what sense are LLMs relevant to our understanding of the processes by which humans acquire and use languages?
- Is there any component of the language faculty (semantics, syntax, pragmatics, morphology, phonology) in which LLMs' knowledge is more similar to that of humans than in others?
- What uses for language research can such systems have?
- What impact will the development of LLMs have on the field of linguistic theory as a scientific discipline?

The initial chapter presents an introduction to the fundamental operations of the so-called Large Language Models (especially ChatGPT) for readers lacking expertise in computational linguistics. Additionally, it offers an introduction to the structure and defining characteristics of the human faculty of language for readers lacking expertise in linguistics. Similarly, an initial examination of the concept of a model in the scientific context is provided, along with an overview of the remaining chapters in this volume, whose authors I sincerely thank for their willingness to get involved in the initiative to produce this book. I would also like to thank three anonymous reviewers who read the manuscript and provided valuable feedback that undoubtedly helped to improve it.

José-Luis Mendívil-Giró

Chapter 3

# Language models as function approximators of text data: disrupting comprehension through and adversarial attack

David J. Lobina
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> [A] computer program that succeeded in generating sentences of a language would be, in itself, of no scientific interest unless it also shed some light on the kinds of structural features that distinguish languages from arbitrary, recursively enumerable sets.
>
> Chomsky (1963, 360)

**Abstract:** Large Language Models such as ChatGPT are examples of Machine Learning models (ML), and as such, they are best regarded as "function approximators," or vast correlation machines. That is, given a dataset, however big, of pairs of inputs and outputs, a ML network will construct a function that best describes (approximates) the distribution in the data, and from whence it can generate similar input-output pairs if prompted. In the case of ChatGPT, the dataset is composed of text—the products of the language faculty. In this sense, ChatGPT does not model a natural language per se, but the statistical distribution of text, the latter treated as recorded, static data. *A fortiori*, the claim that some of the results emanating from the development of Large Language Models bear any consequence for the study of language, especially regarding linguistic competence and acquisitional studies, appear to be the case of committing a category mistake.