# Can we reach AGI and what is AI?

Artificial Intelligence, especially through Large Language Models (LLMs), is revolutionizing user experiences by generating human-like text and making technology more accessible via natural language interfaces. These models, designed to predict the next word in a sequence based on context, significantly enhance productivity by automating tasks such as summarization, translation, and content creation. LLMs operate by predicting the next word in a sequence based on the context provided by preceding text. This design enables them to perform tasks such as summarization, translation, and content creation with remarkable efficiency. By learning patterns from vast amounts of text data, LLMs can generate text that is linguistically correct and coherent, significantly reducing the time and effort required for these activities.

LLMs excel in mimicking the structure and syntax of human language due to their ability to learn patterns from vast text data. This makes them proficient at generating linguistically correct and coherent text. However, despite their impressive linguistic capabilities, LLMs lack genuine reasoning or understanding. They rely on statistical patterns and correlations without comprehending the deeper meanings of language.

Research by cognitive scientists like Evelina Fedorenko underscores the differences between human cognition and artificial intelligence. Functional magnetic resonance imaging (fMRI) studies reveal that different parts of the human brain are activated for language tasks and for general reasoning or higher-level cognition. Fedorenko's work shows that there is a specialized network in the brain dedicated solely to language processing, distinct from areas involved in reasoning and problem-solving.

This neural separation highlights a fundamental distinction: while the human brain has specialized pathways for different cognitive functions, LLMs use a uniform architecture to handle all tasks. This uniformity limits their ability to truly reason or understand language in the nuanced way humans do.

The limitations of LLMs become evident when they are tasked with problems requiring logical reasoning. While they perform admirably on benchmarks focused on language generation, they struggle with tests that demand deeper cognitive abilities. This discrepancy underscores their role as language models rather than reasoning entities.

In essence, LLMs are powerful tools for modeling the form of language, leveraging massive datasets and sophisticated algorithms to generate human-like text. However, their lack of true comprehension and reasoning capabilities sets them apart from human cognition. The distinction is clear: LLMs are masters of linguistic form, but when it comes to reasoning, they remain mere apprentices. For this reason, it is unlikely we will see AGI any time soon.

Further Reading

1. Bender, E. M., & Koller, A. (2020). [Climbing towards NLU: On Meaning, Form, and Understanding in the Age of data](https://www.aclweb.org/anthology/2020.acl-main.463/)
2. Blank, I. & Fedorenko, E. (2017). Domain-general brain regions do not track linguistic input as closely as language-selective regions. *Journal of Neuroscience,* 37(41), 9999-10011.
3. Brown, T., et al. (2020). [Language Models are Few-Shot Learners](https://arxiv.org/abs/2005.14165)

Fedorenko and Varley 2016: Language and thought are not the same thing: evidence from neuroimaging and neurological patients

Is thought possible without language? Individuals with global aphasia, who have almost no ability to understand or produce language, provide a powerful opportunity to find out. Surprisingly, despite their near-total loss of language, these individuals are nonetheless able to add and subtract, solve logic problems, think about another person's thoughts, appreciate music, and successfully navigate their environments. Further, neuroimaging studies show that healthy adults strongly engage the brain's language areas when they understand a sentence, but not when they perform other nonlinguistic tasks such as arithmetic, storing information in working memory, inhibiting prepotent responses, or listening to music. Together, these two complementary lines of evidence provide a clear answer: many aspects of thought engage distinct brain regions from, and do not depend on, language.

From the Fedorenko paper: