

The Chomsky Hierarchy

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Noam Chomsky is a renowned linguist whose ideas were recognized and applied by computer scientists to lay foundations of our discipline. I admire him for his support of justice.

- Read about Noam Chomsky on Wikipedia and summarize his salient contributions to our computing discipline.
- Outline the Chomsky Hierarchy giving what we now call
 - Regular Languages
 - Context-Free Languages
 - Context-Sensitive Languages
 - Unrestricted Languages
- Read about Grammars Wikipedia. Report on what you find interesting.

1 Chomsky

Avram Noam Chomsky born December 7th 1928 is an American linguist, philosopher, political activist, and many more. Dubbed the father of modern linguistics, Chomsky helped establish the field of cognitive science.

Chomsky's early works had him studying at the University of Pennsylvania to which post graduation he began studying at Harvard Society of Fellows. From here he earned his doctorate in 1955 for his theory on transformational grammar, and released the book *Syntactic Structures* in 1957 which helped redevelop the study of language. In the years following Chomsky helped create the universal grammar theory, and the famous Chomsky hierarchy. He then went on to help create the minimalist program, and lead a life of activism. He has since settled down to teach at the University of Arizona as of 2017.

In the context of computer science Chomsky has a few very notable works. His book *Syntactic Structures* contains his theory on transformational-generative grammar (originally published in his 1955 dissertation), and the Chomsky hierarchy.

Syntactic Structures covers the formality of syntax, and the symbols and rules comprising it. He does this via something he refers to as phase structures. He then applies his new rules called transformations. Without going too in depth these transformations through mathematical notation can generate all grammatical sentences of a language. This is the basis of formal languages, and how they may be constructed via grammars.

The Chomsky Hierarchy is a way of grouping all logical possible phrase-structure grammars into nested subsets with these grammars becoming more complex as we move up. This hierarchy contributed greatly to the study of formal language theory, programming language theory, compiler construction, and automata theory.

2 Chomsky Hierarchy

TYLER & ???

2.1 Regular Languages

(TYLER)

2.2 Context-Free Languages

(TYLER)

2.3 Context-Sensitive Languages

(???)

2.4 Unrestricted Languages

(???)

3 Grammars

Grammar can be used to describe behavior of groups of speakers, grammar can be used to demonstrate the language of not only an entire group of individuals but also subsets within that group. It's interesting how grammar changes depending on what sample of people you are looking at. Geography has an influence on the way that individuals speak.

With regards to history, it is interesting that the "earliest known grammar handbook is the *Art of Grammar*" was written by an ancient Greek scholar in 90 BC. Throughout history grammar has been based off of the grammar of other languages, each society basing it's grammar off of an older language, demonstrating that grammar that is used today have evolved from ancient languages. Grammar has also been a topic of study throughout many time periods including the Middle Ages.

Grammar evolves with time and usage most notably through the observation and documentation. Sentences that have slight variations in language can have rather large differences based on context. It is interesting to think that grammar has defined rules however, the evolution of language changes the definition of such rules. Demonstrating that grammar rules are dictated by those who break grammar rules.

There is a difference in grammar in an academic setting and in the real world, vernacular dialects and standard language respectively.