Subregular toolkit implemented in Python

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A mysterious puzzle

Russian

1a. zavtra
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1b. posle-zavtra
the day after tomorrow

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Why is (2c) impossible?

Human language and its complexity

Why does the complexity of human language matter?

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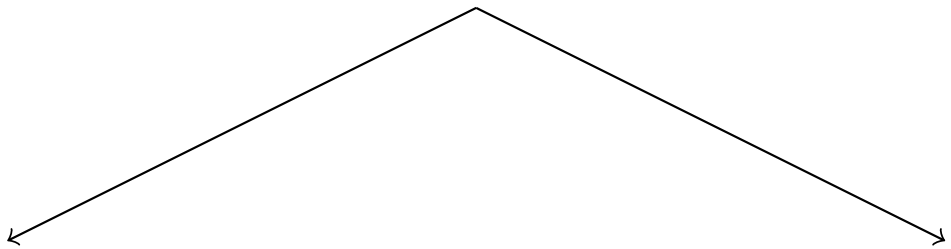

Science **Industry**

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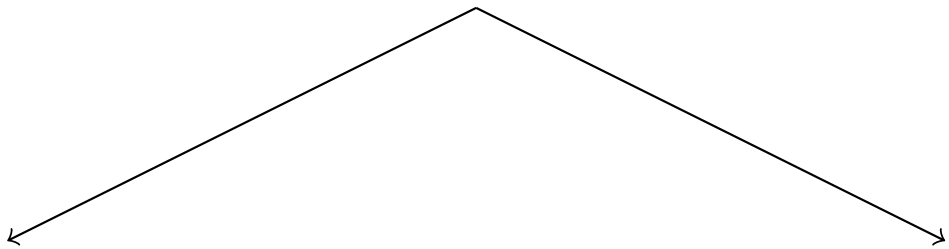


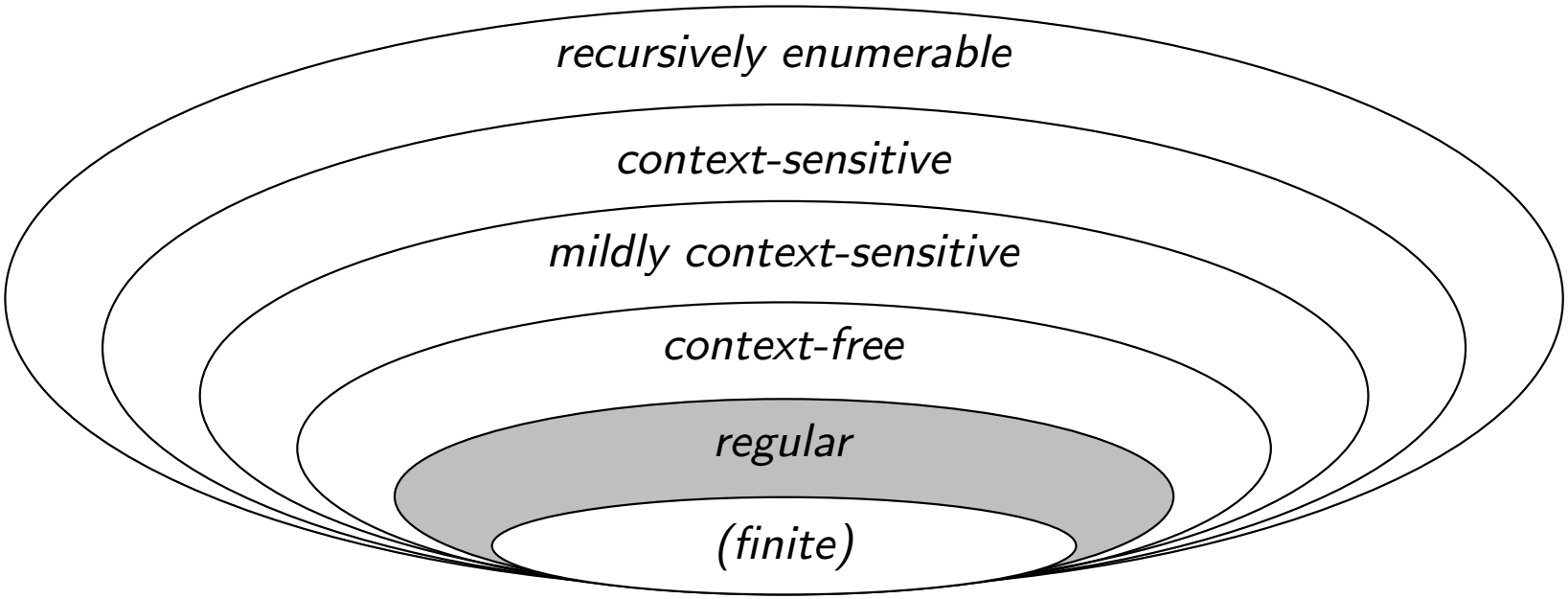
Science

Classifying an object in terms of its complexity helps to study and predict its properties.

Industry

Knowing types of dependencies, we can design better processing techniques and learners.

The Chomsky Hierarchy of String Languages



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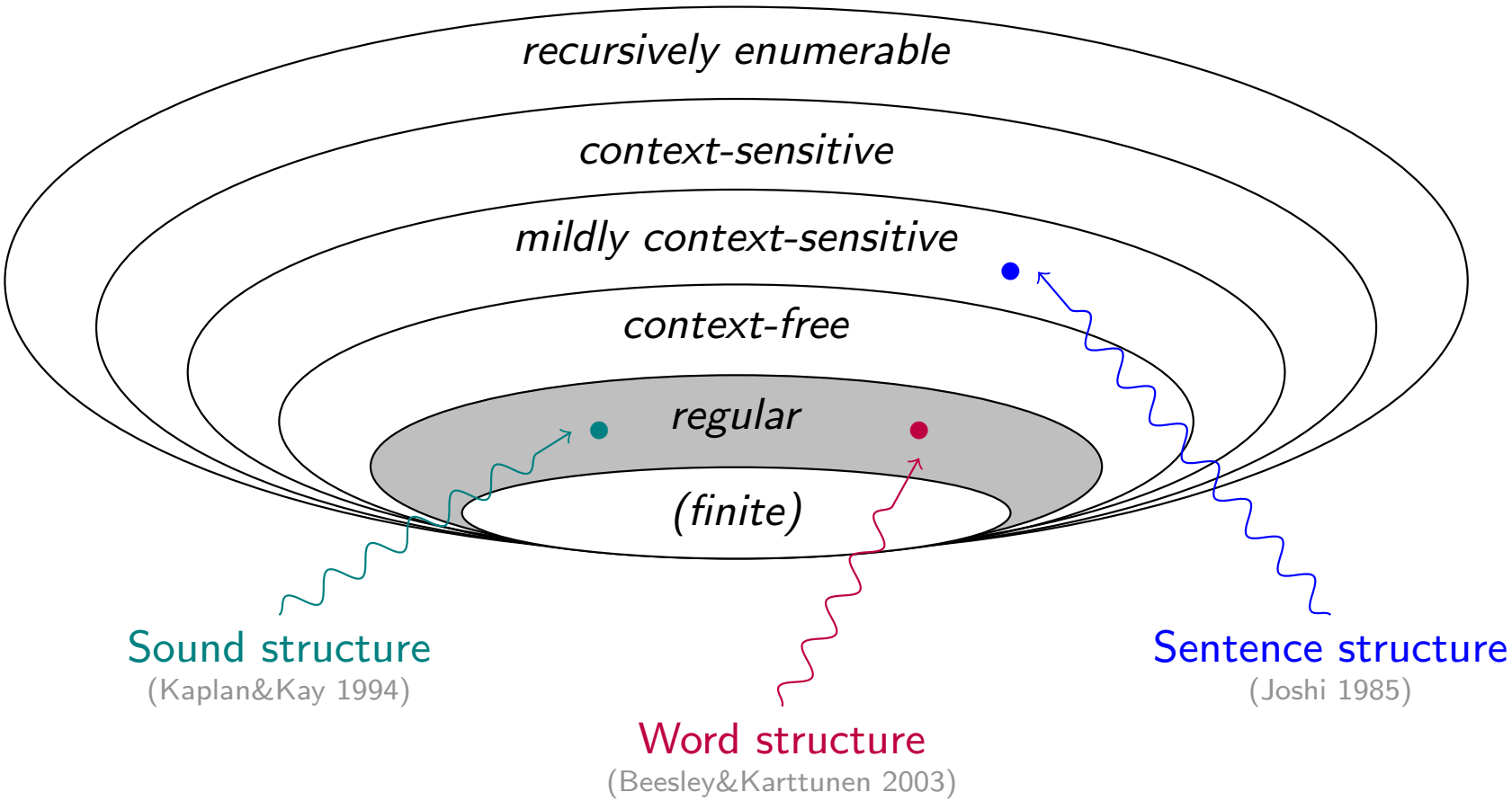

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Regular languages = FSA recognized = MSO definable

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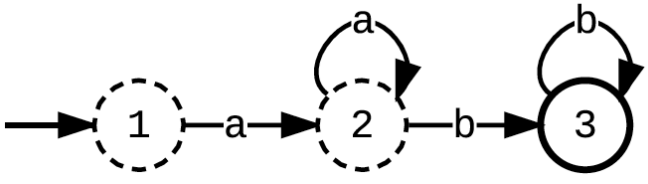

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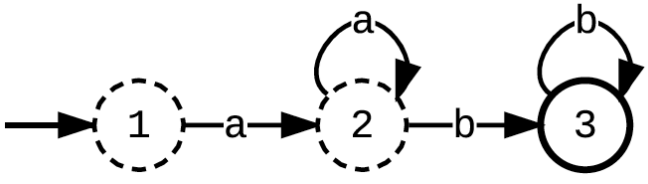

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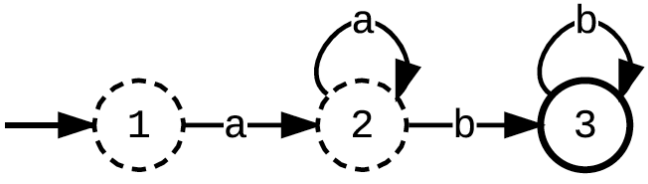

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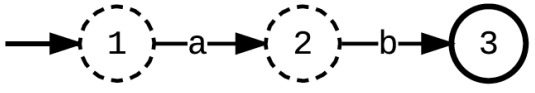

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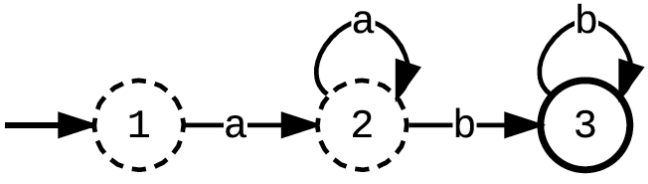

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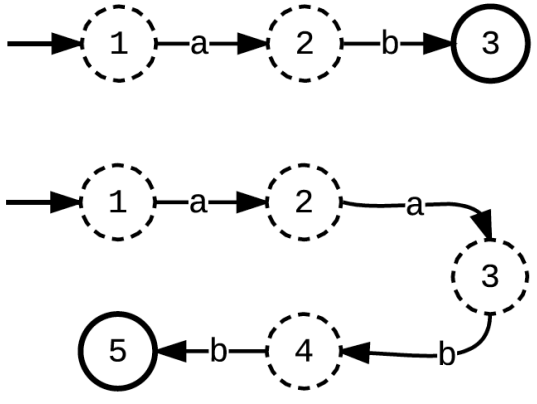

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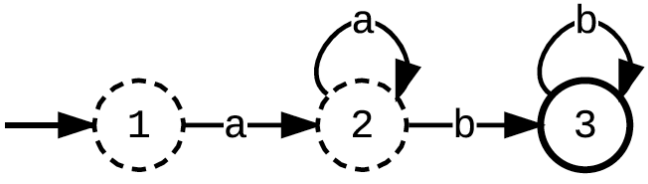

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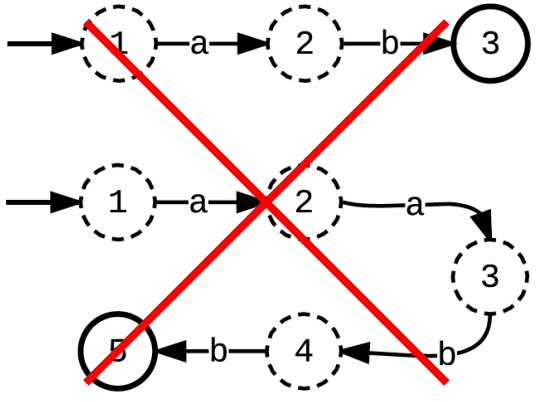


. . . no general FSA can be constructed

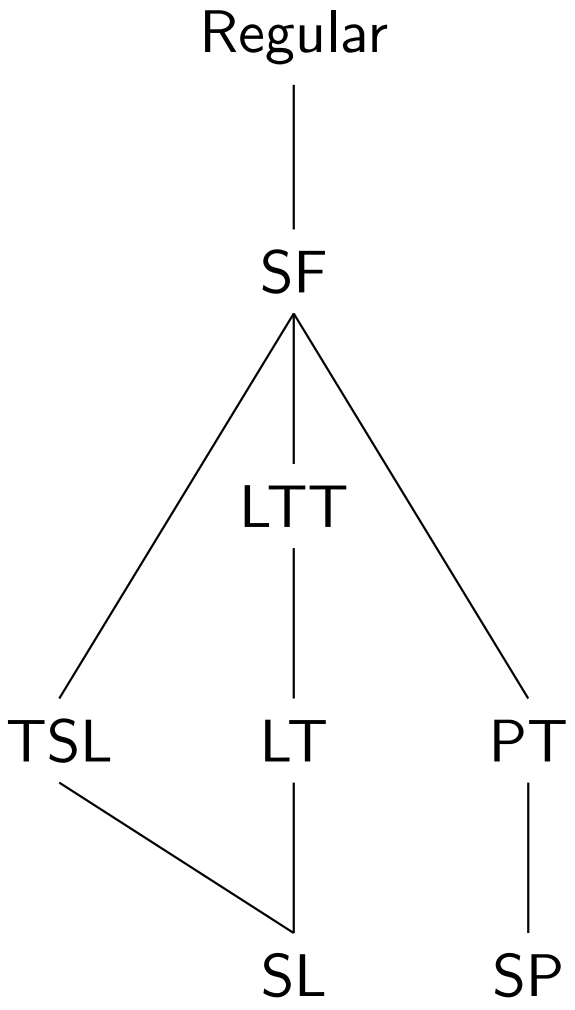
Context-Free

Subregular Hierarchy

The class of regular languages can be decomposed into **subregular hierarchy**

- Introduced by McNaughton&Papert (1971)
- Expanded by numerous researchers

Subregular hierarchy



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The most fruitful class for the NL is tier-based strictly local languages (TSL).

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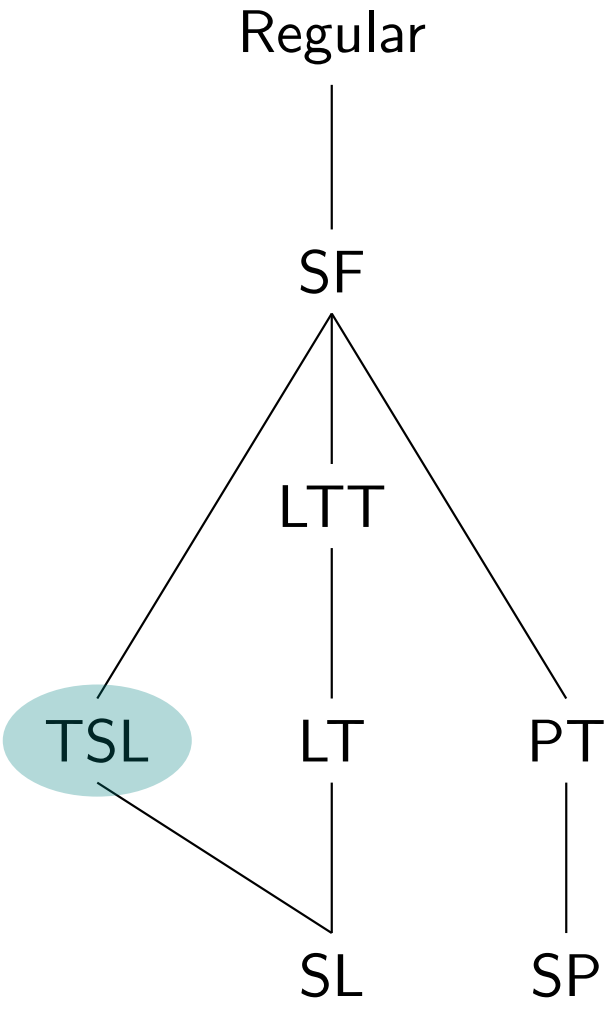

TSL intuitions

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*ab constraint:

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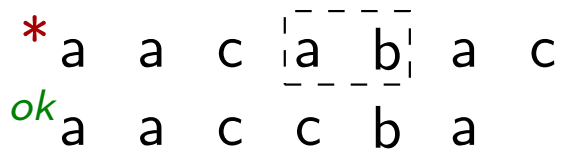
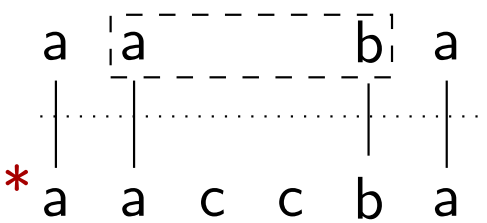


TSL grammar is a SL grammar of a certain subset of the alphabet (*tier alphabet*). Other elements are ignored.



TSL example: (im)possible iteration

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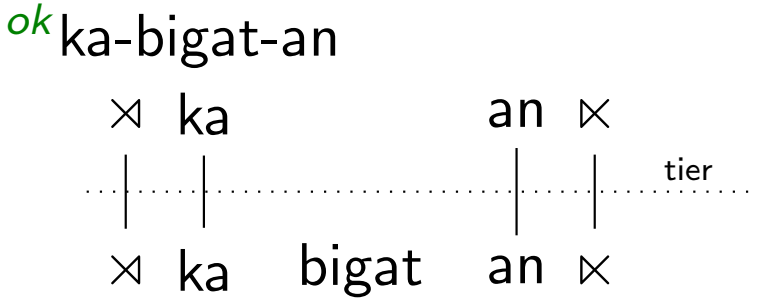
- Russian & Ilocano: radically different, both TSL
- 2c pattern: not TSL, unattested

TSL example: (im)possible iteration [cont.]



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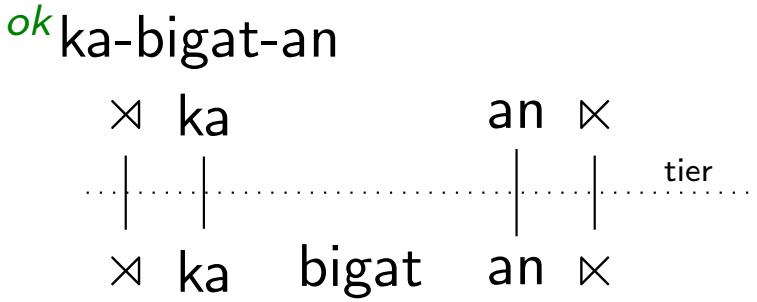
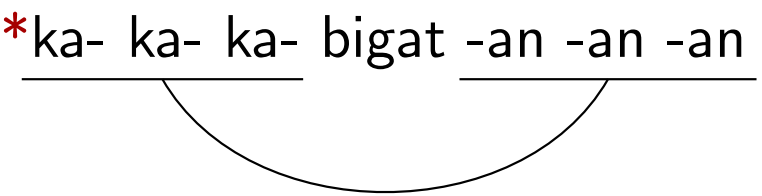
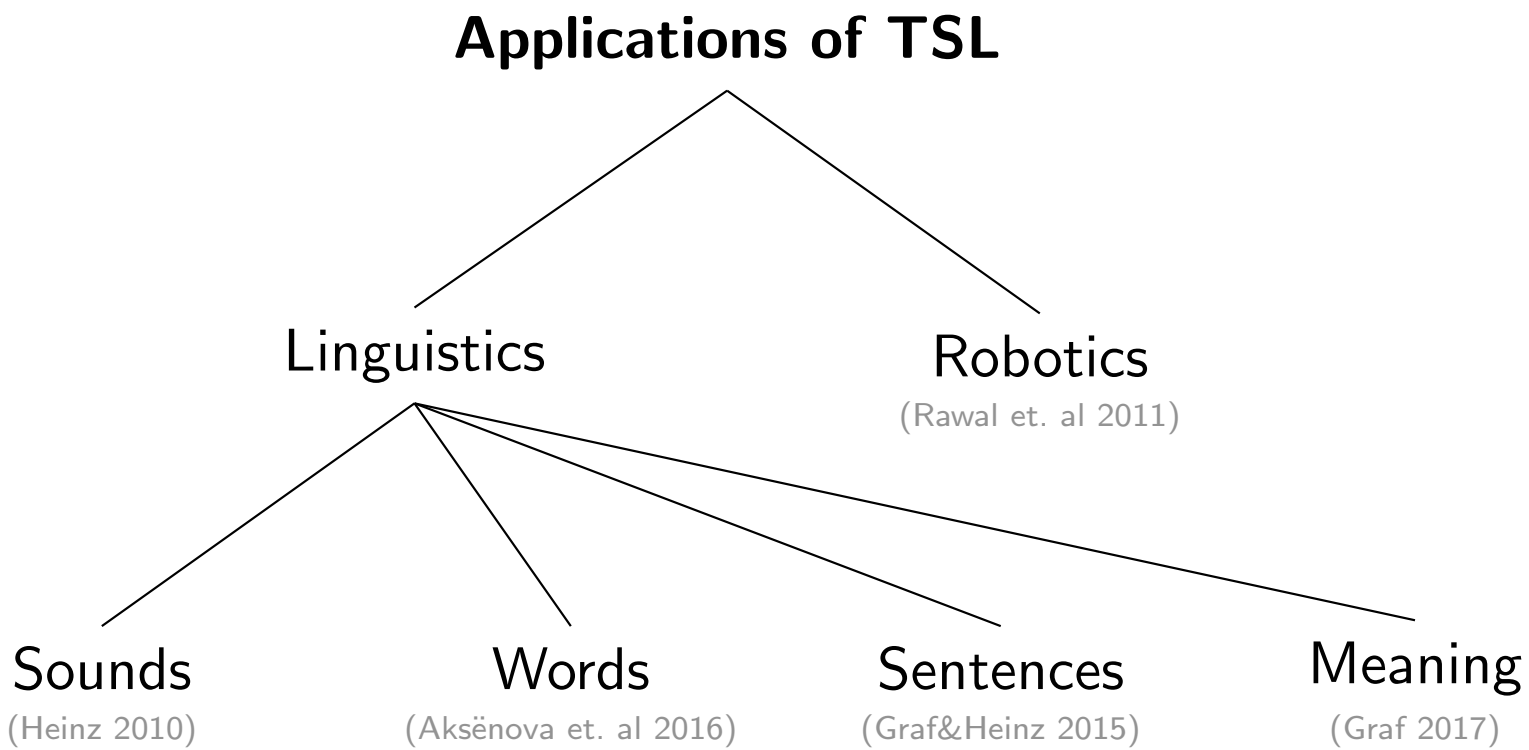




$a^n b^n$ pattern $\rightarrow$ CFG!

Applications of TSL



Subregular toolkit: motivations

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- A way to implement learners for subregular languages and measure their performance.
- A possibility to use subregular tools in "real life" for language processing problems.
- An instrument to explore learnability of certain types of NL patterns.

Subregular toolkit: what's in it?

Tools:

- Sample generators
- Scanners
- Learners

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Language classes (minimum):

- Strictly local
- Tier-based strictly local
  - "standard" definition
  - with structural projection mechanism
  - with multiple tiers
- Strictly piecewise
- ... and other subregular classes

Subregular toolkit: details

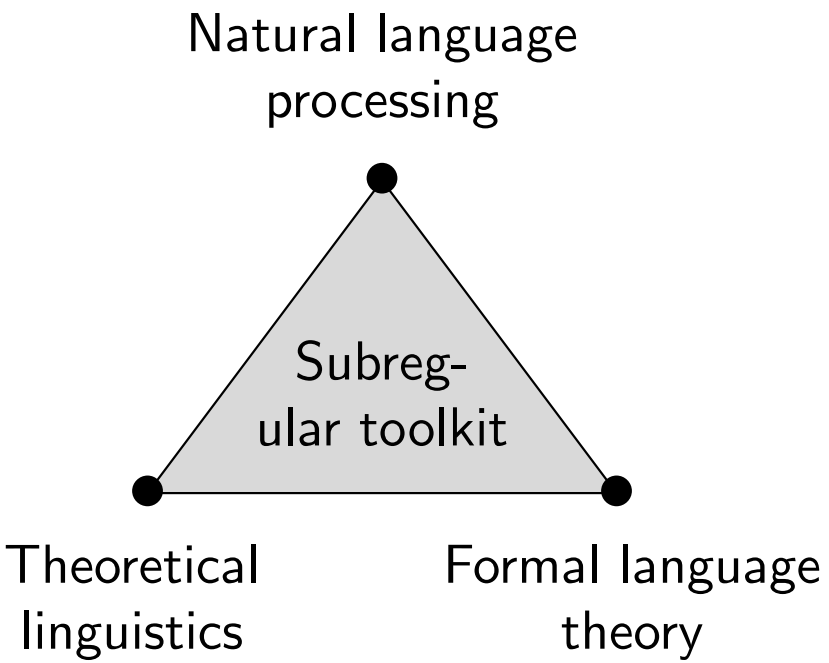
- Python 3 (available via `pip`)
  # Python is widely used in scientific community
- Open source
  # to make it available for further enhancement
- With GUI
  # to simplify the use

- Available on GitHub
  # `https://github.com/loisetoil/slp`

Summary

Subregular toolkit allows:

- test ideas currently available in literature;
- explore new methods to model NL;
- seek out new ways to improve the results.



Thank you!

> [Science] is a system for testing your thoughts against the universe and seeing whether they match.
>
> *Isaac Asimov*

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