Grand challenges = Big problems

- Hard to tackle
- Some cases can be cast in computational terms
  - MT: sequence-to-sequence
  - Hard to represent entire world knowledge
- Language provides theoretical background
- Decompose!
  - Let's build pipelines

Smaller challenges

- Letters in words
- Words
- Words in a sentence

Phonology and morphology

- Letters in words can describe their sounds
- Grouped to form *phonemes*
  - *p/b* in *pit / bit*

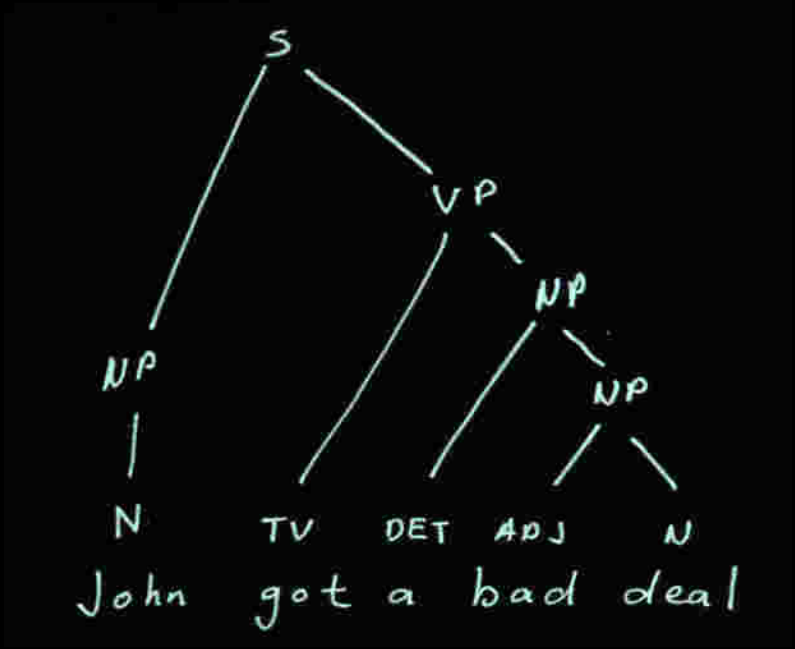
- Letters also group to form semantic units
- Smallest groups are *morphemes*
  - [*disagree*]*/d/ment/s*
  - [*run*]*ning/ner/s*

Parts of speech

- Categories of word
  - Verb, noun, adjective
- Each word can belong to more than one category
  - *The river bank*
  - *Bank this money*

  - *I work at Google*
  - *I google at work*

Grammar

- Chunking
  - Find sequences of words that represent a concept
  - I [ran quickly] towards [the blue bus]
  - Useful for getting key phrases

- Parsing
  - Build tree structure of sentence