# Beyond rationalism versus empiricism

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# Be clear about your goals

- *Engineering is different to science*
  - science is about *insight* and *understanding*
  - engineering is about *making things work*
- *Be clear about what you're trying to achieve*
  - this determines *what counts as success*
- The importance of a scientific insight is *not proportional to how useful it is*
  - you can bake a tasty cake without knowing chemistry!
- *Which knowledge is most useful depends on what your goals are!*

# Capturing vs. covering a linguistic generalization




- *Capturing a generalization*: grammar accurately describes phenomenon at appropriate level, e.g., subject-verb agreement via PERSON and NUMBER features
- *Covering a generalization*: model covers common cases of a generalization, perhaps indirectly. E.g., head-to-head POS dependencies
- An "engineering" parser only needs to cover generalizations
- But feature design requires *linguistic insight*
  - *basic linguistic insights have greatest impact*

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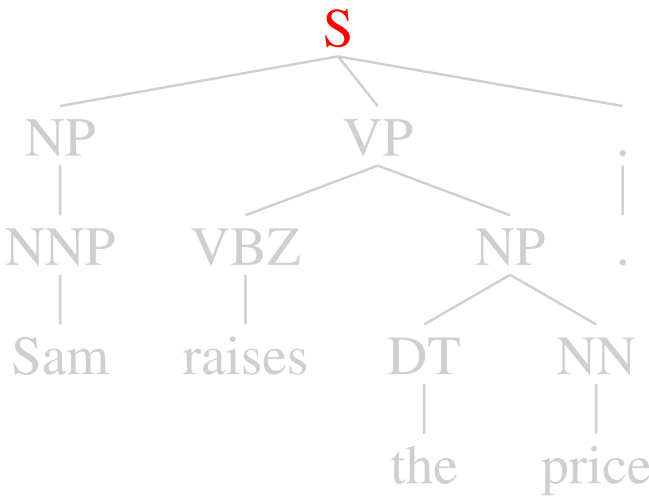


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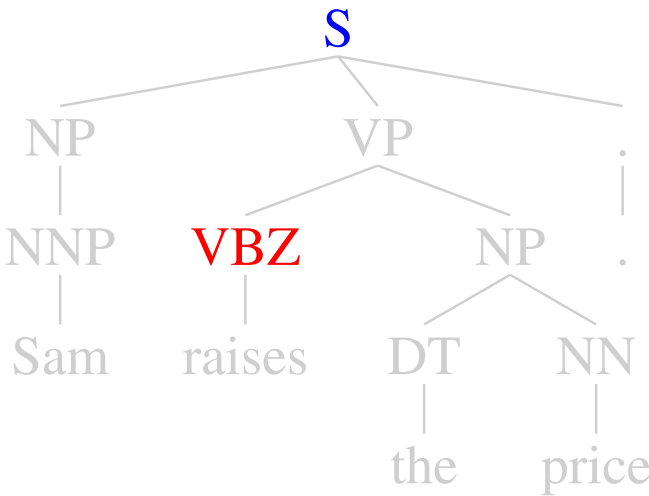


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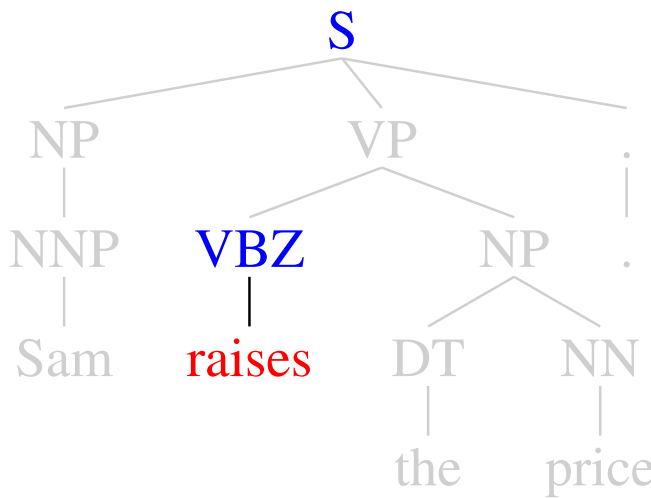


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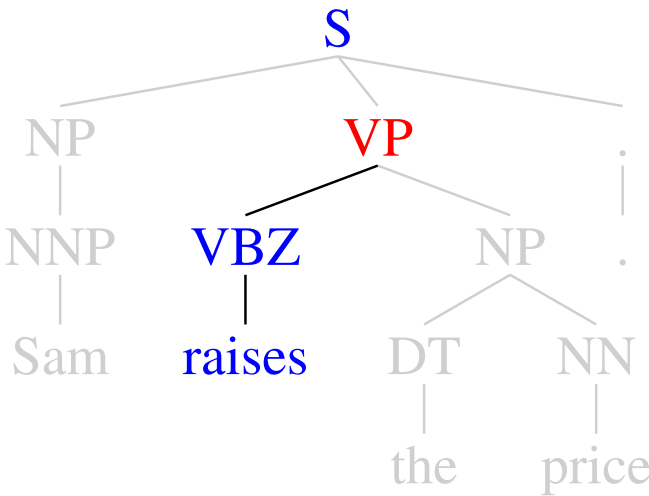


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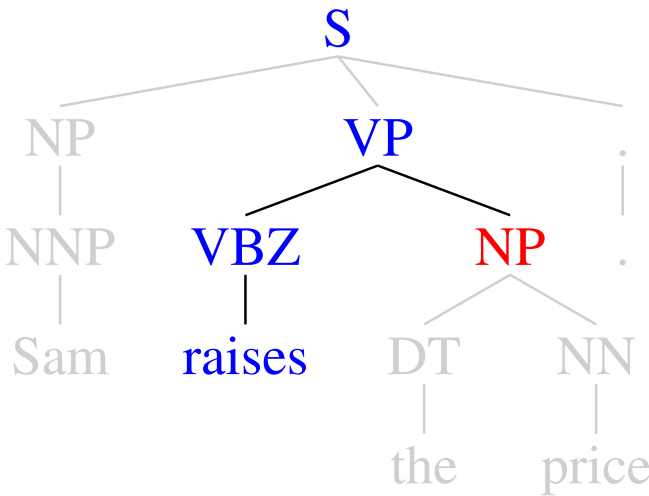


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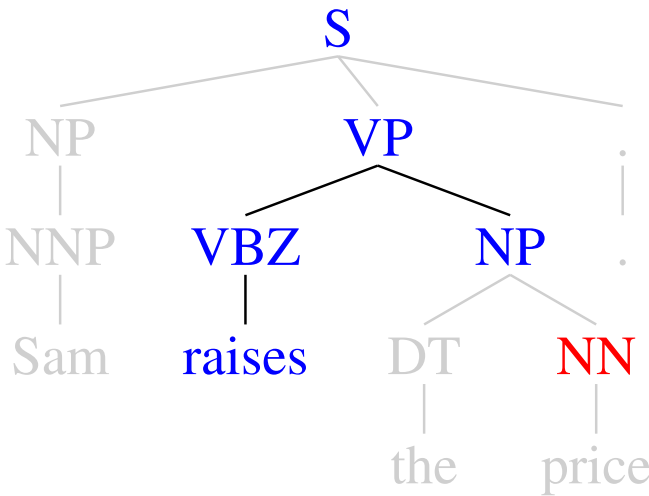


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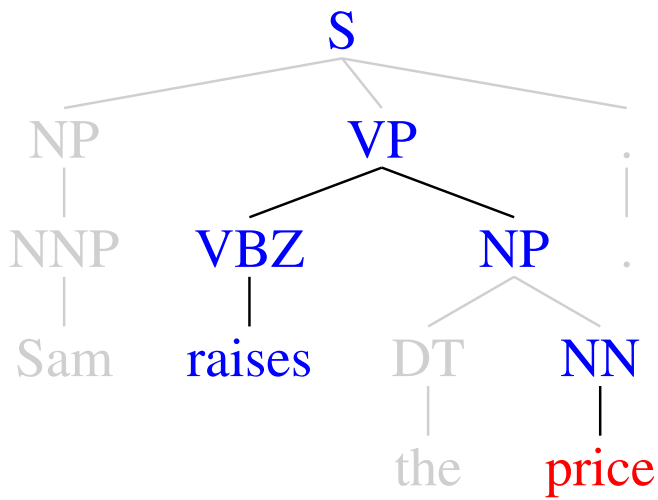


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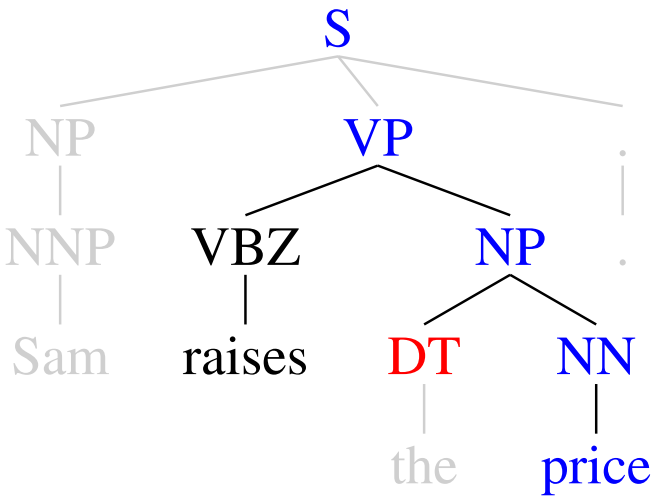


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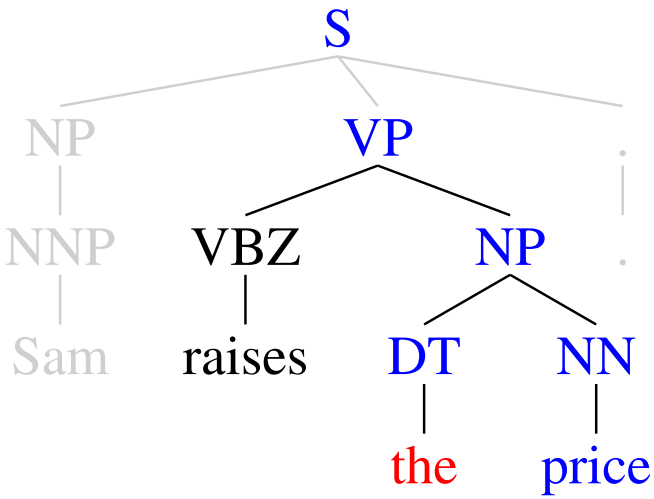


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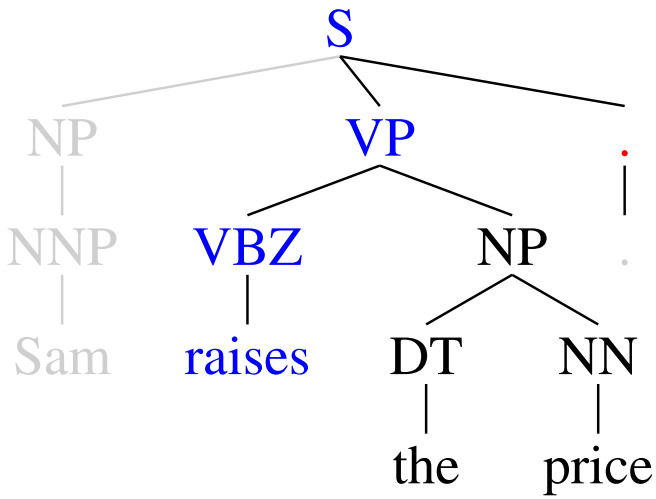


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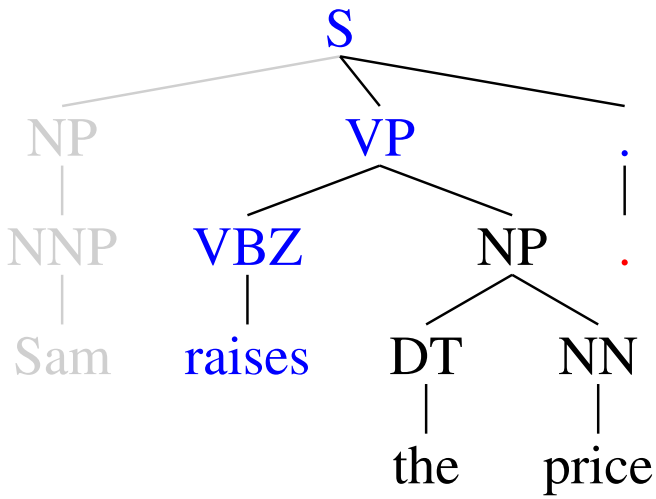


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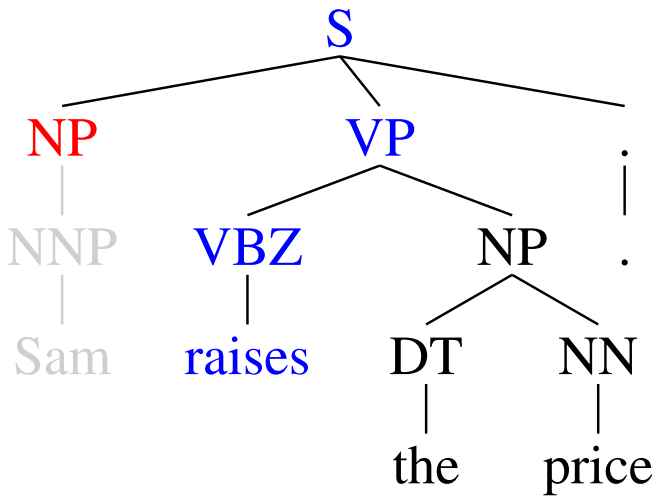


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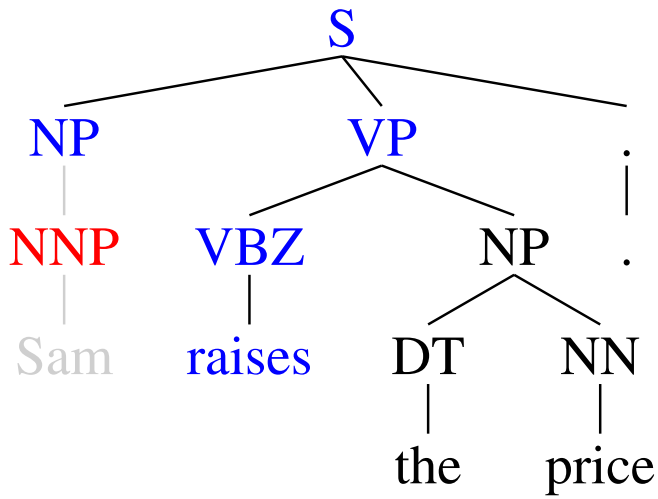


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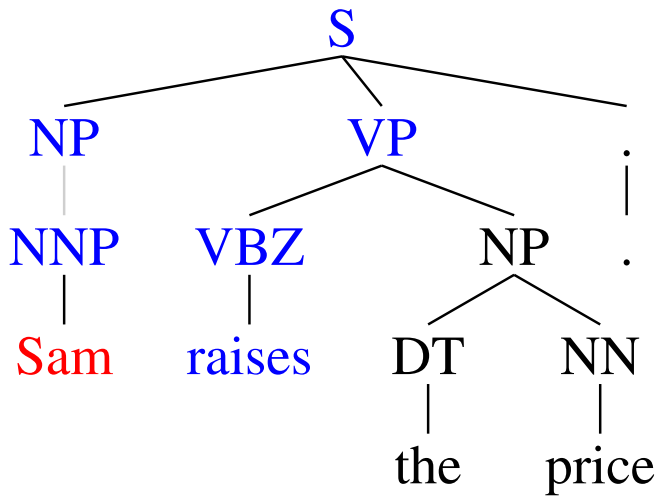


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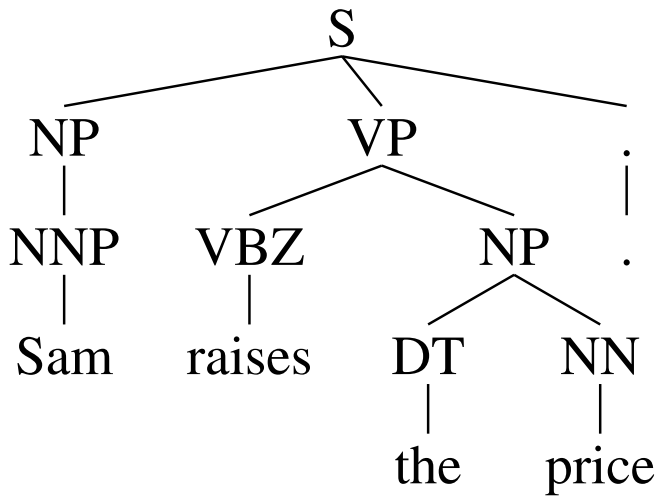


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# After all the low-hanging fruit is gone …

- Early statistical NLP focused on surface generalisations
  - but many of the simple ideas have been tried already
- Linguistic structure can help generalise better
  - e.g., Chelba and Jelinek "Structured language model" (aka *shift-reduce parser*)
  - theoretically most interesting ideas $\neq$ most useful ideas

    $\Rightarrow$ *try the simple stuff first!*
- *Look beyond theoretical linguistics* to:
  - **language acquisition, psycholinguistics**
  - **language typology, historical linguistics**
  - **neuroscience, genetics**
- Our field still *lacks many central insights*
  - nobody knows where they'll come from

  $\Rightarrow$ *it's foolish for the field to put all our "theoretical eggs" in one basket!*

# Theoretical and computational linguistics have different goals

- A "parasitic gap" is a syntactic construction with one "filler" and multiple "gaps"

  *Which book did you buy _ before reading _ ?*

- Linguists have published many articles on parasitic gaps
- There are very few parasitic gaps in the PTB WSJ corpus

  $\Rightarrow$ covering parasitic gaps won't change your PTB f-score
- Rare phenomena can be *scientifically very important*
  - Chomskyians argue that parasitic gaps must be innate because they are too rare to be learned

  and if you're parsing a genre where parasitic gaps are common, you probably should pay attention to them!

# Research is a gamble about the unknown

*Half the money I spend on advertising is wasted.*
*The problem is: I don't know which half.*
— John Wanamaker

- Nobody knows what knowledge will turn out to be most important
  - that's why it's research!
- In an ideal world we'd all know everying ...
  - but *time spent learning something is time not spent learning something else*
  - you are gambling that the knowledge you acquire today will be useful in tomorrow's research
- It's easy to identify grand goals ...
  - but it takes genius to *identify a set of achievable steps that will reach a grand goal from where we are today*

# Look forward, not backward!

- There are still deep scientific mysteries in our field; e.g., *compositionality*
  - how are trees be represented in the brain's neural circuitry?
  - our statistical models reduce tree structures to finite-dimensional feature vectors of sufficient statistics
    - this is a lossy many-to-one mapping

    $\Rightarrow$ the tree cannot be recovered from the feature vector
    - *are there more insightful mathematical models of compositional structures?*
- Understanding language and thought will probably require *synthesising and extending empiricist and rationalist insights* (and much more as well)
- Learn from the past, but look to the future!