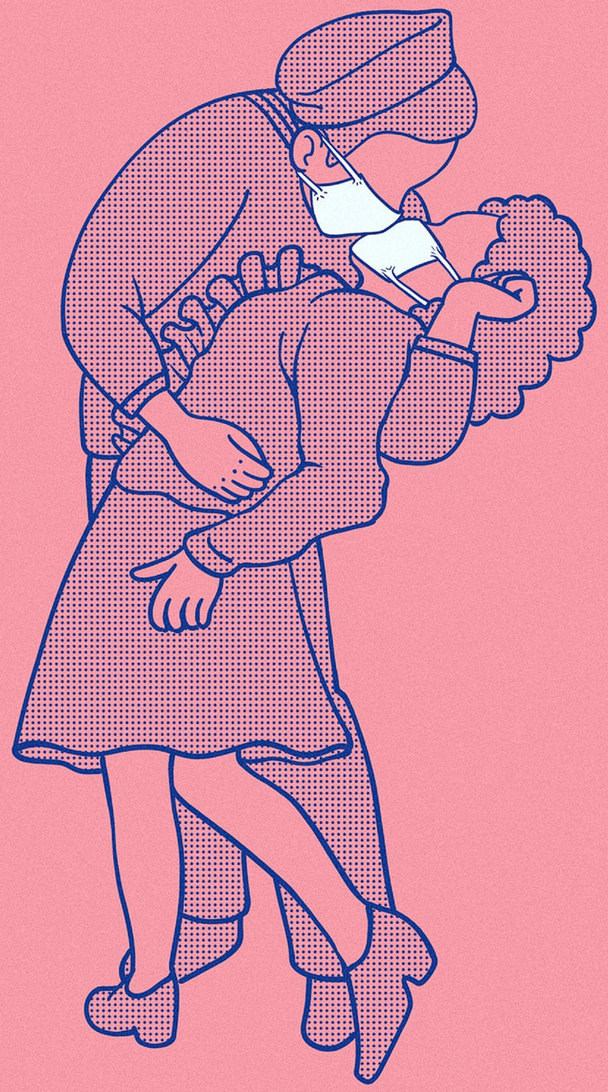
Neural·Pragmatic
Natural
Language
Generation

N·P
NLG



en pee en el what?

natural language generation (NLG)

- established subdiscipline of CL

neural NLG

- NLG using (deep) neural networks

pragmatic NLG

- inspiration from pragmatic theory

npNLG

- neural NLG inspired by pragmatic theory

natural language generation

Natural Language Generation

> “ [T]he subfield of artificial intelligence and computational linguistics that is concerned with the construction of computer systems than can produce understandable texts in English or other human languages from some underlying non-linguistic representation of information. ”

Reiter & Dale (1997)

Natural Language Generation

Example applications

∅-to-text

story generation

jokes

names

…

text-to-text

machine translation

summarization

correction (spelling, …)

question-answering

question-generation

dialogue systems

…

data- or img-to-text

weather reports

explanations of AI

image captioning

route descriptions

video event descriptions

…

Goals and evaluation metrics

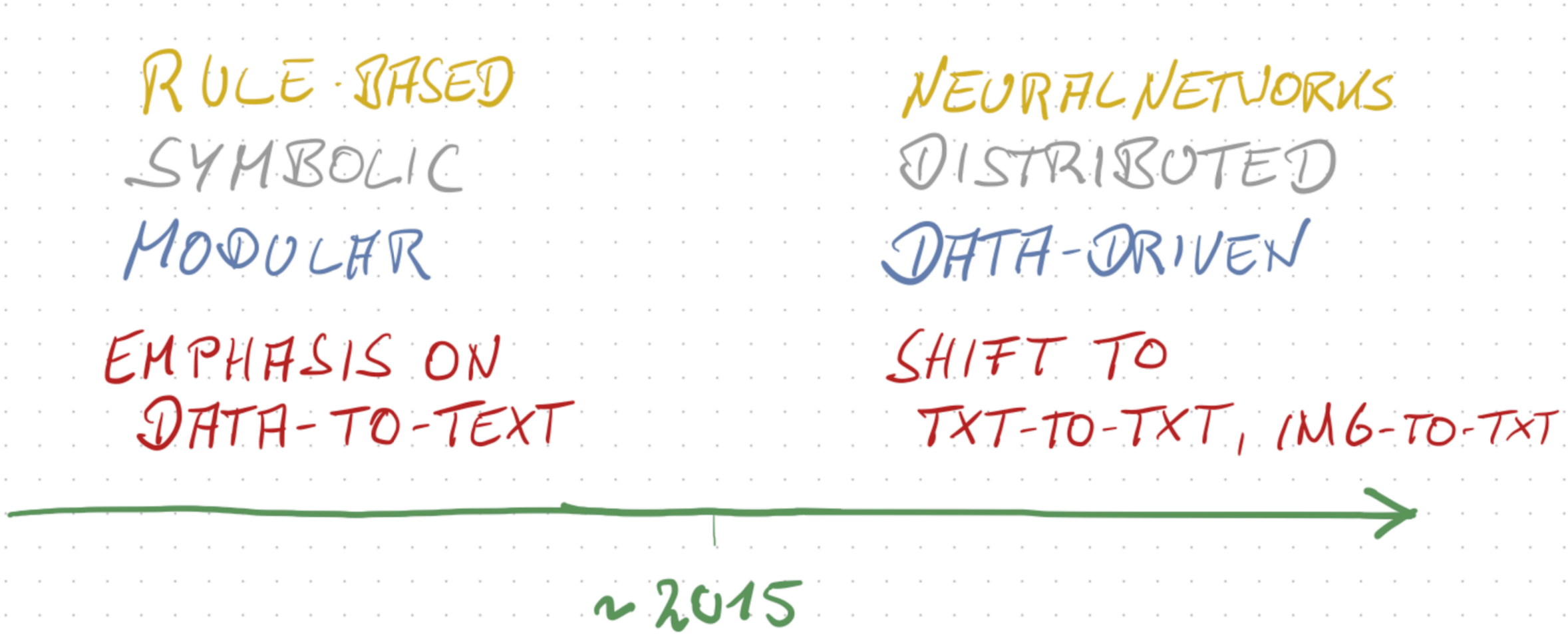
purposes / goals

interpretation / summarization
information gain
entertainment
assistance
motivation, persuasion
…

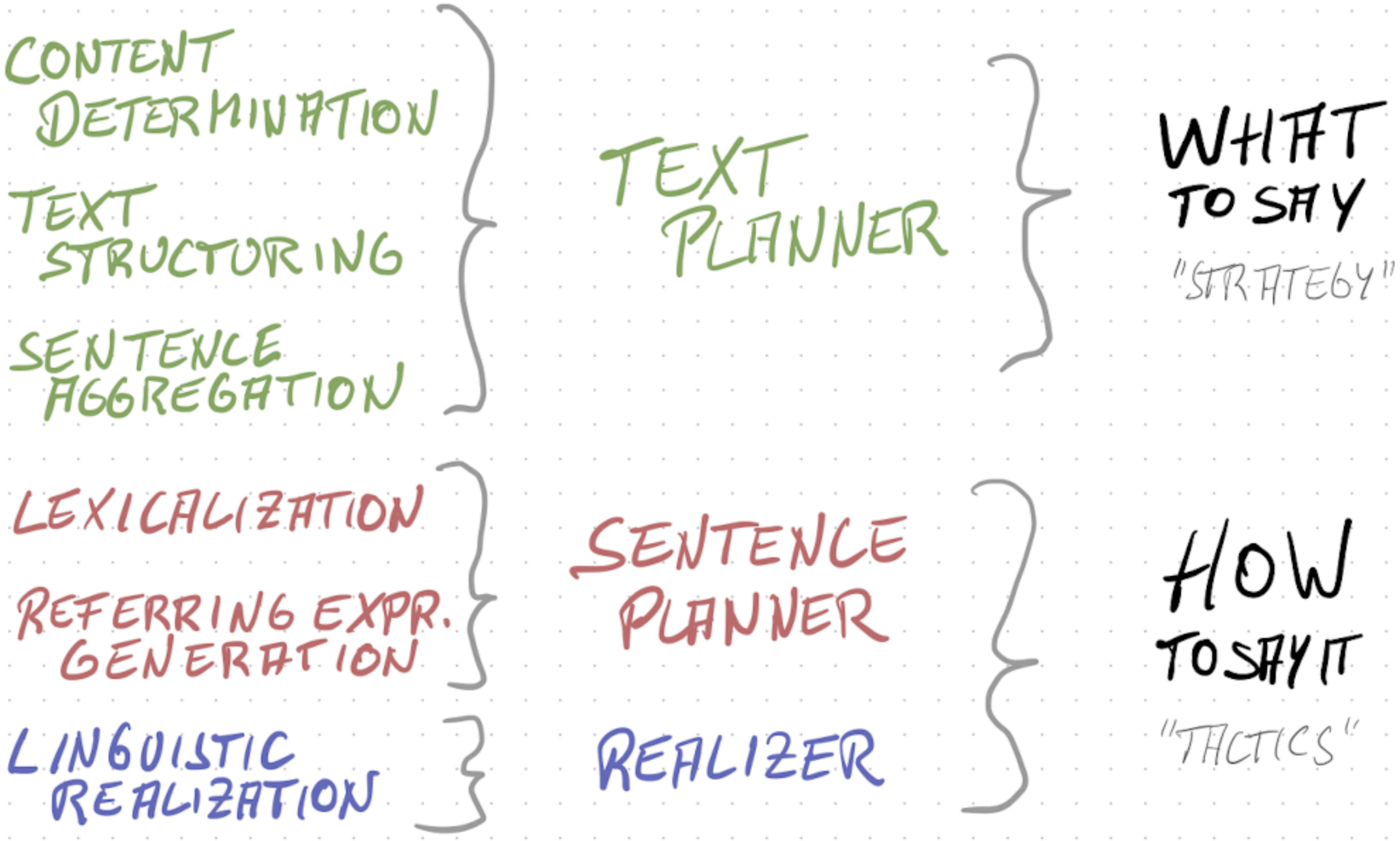
evaluation metrics

truth, accuracy, information quality
relevance, completeness
grammaticality, naturalness
novelty, artistic value
style, bias, affect
…

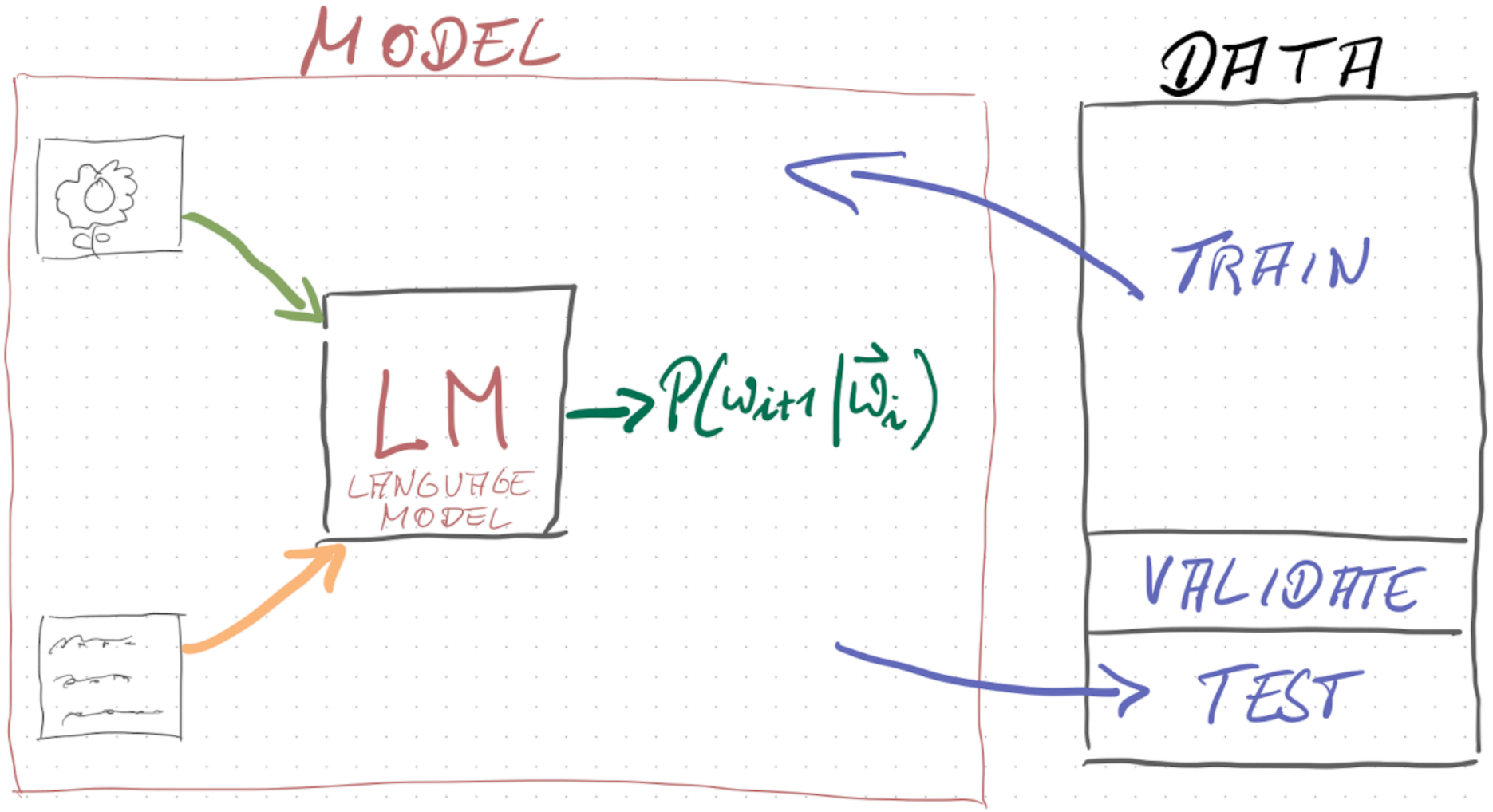
Different approaches to NLG



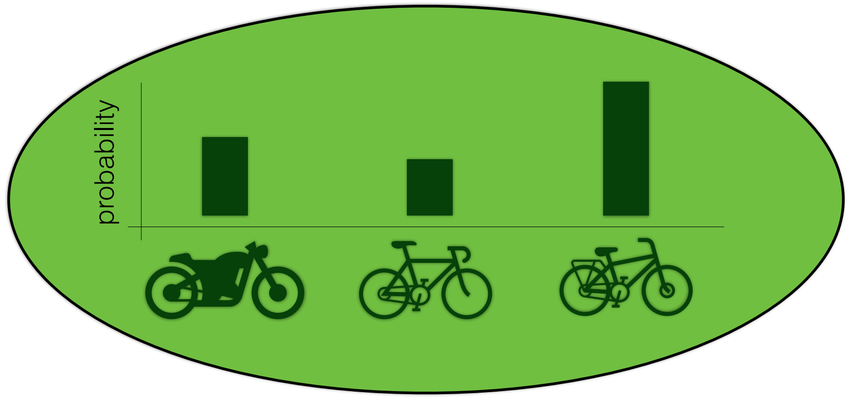
Rule-based (symbolic, analytic, modular) NLG



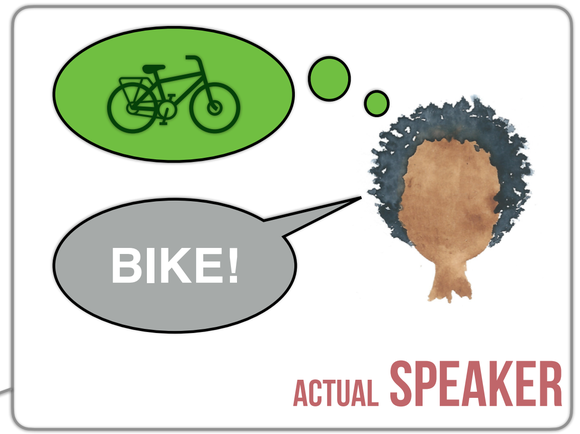
Neural language models (grounded in images)

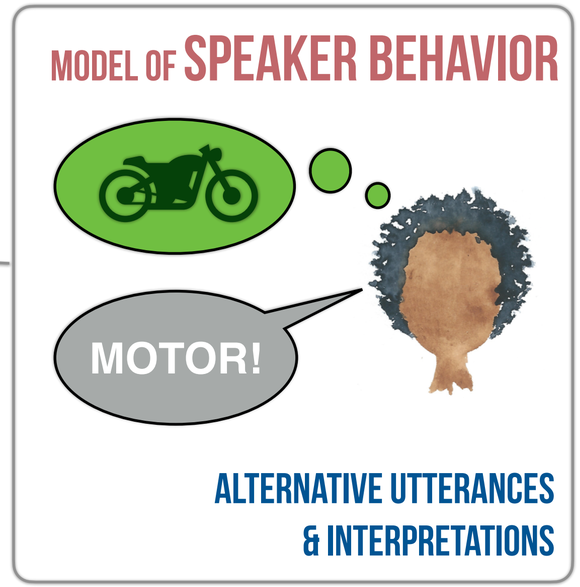


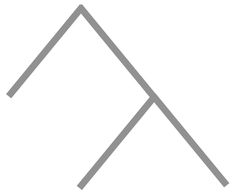
probabilistic pragmatics



PRAGMATIC INTERPRETER







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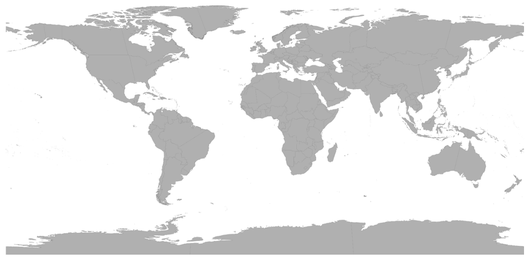
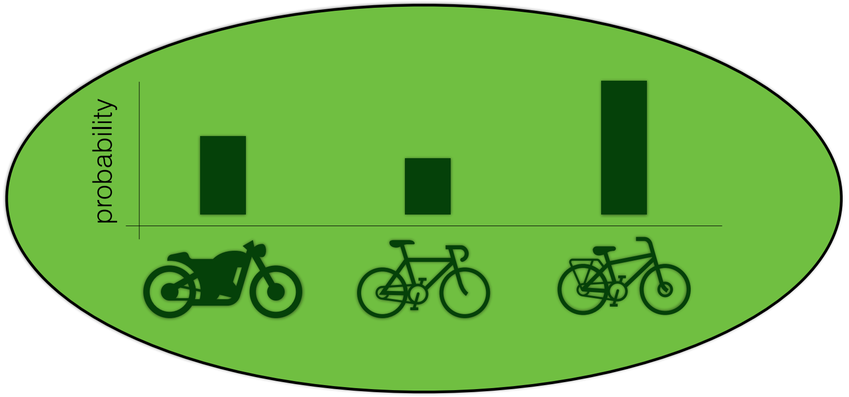
$[\![\text{Joe}]\!] = \lambda e \,.\, \lambda w \,.\, \text{Joe}(e, w)$

KNOWLEDGE OF LANGUAGE



GENERAL WORLD KNOWLEDGE

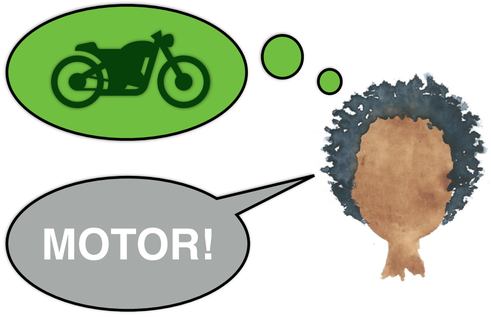
ACTUAL CONTEXT OF CONVERSATION



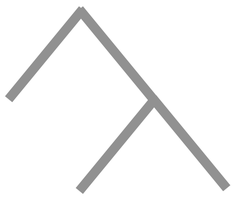
PRAGMATIC INTERPRETER

ACTUAL SPEAKER

MODEL OF SPEAKER BEHAVIOR



ALTERNATIVE UTTERANCES
& INTERPRETATIONS



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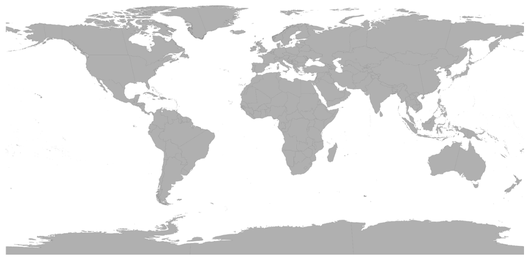
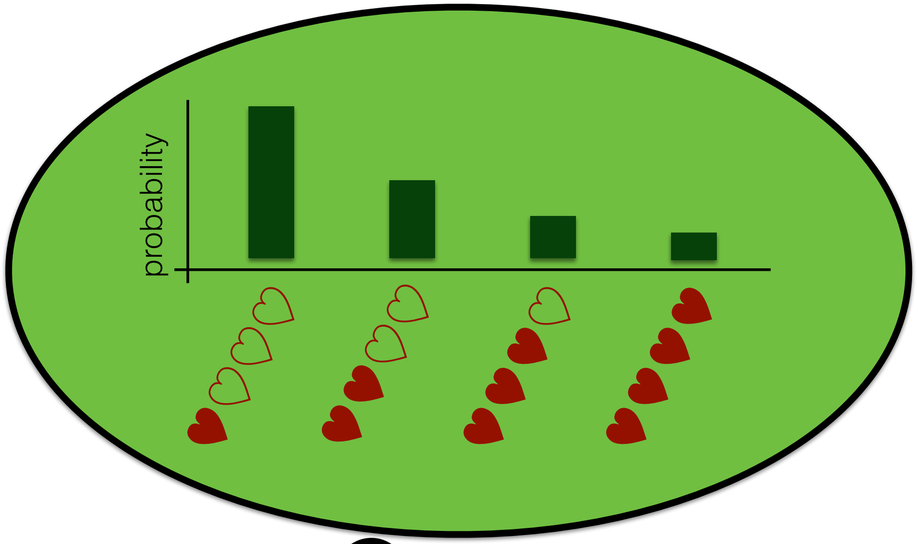
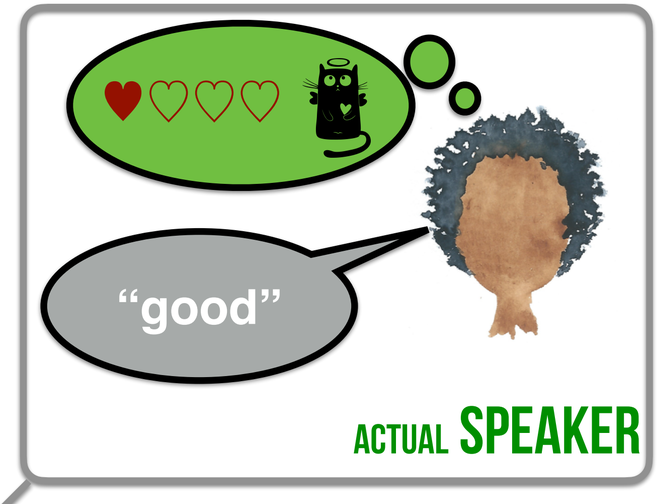


GENERAL **WORLD KNOWLEDGE**

ACTUAL **CONTEXT** OF CONVERSATION



PRAGMATIC INTERPRETER



ACTUAL **SPEAKER**

MODEL OF **SPEAKER BEHAVIOR**

ALTERNATIVE UTTERANCES
& INTERPRETATIONS

Rational Speech Act (RSA) model

PRAGMATIC SPEAKER

$$P_S(u \mid s, \ldots) = \mathrm{SM}\left(U(s, u, \ldots)\right)$$

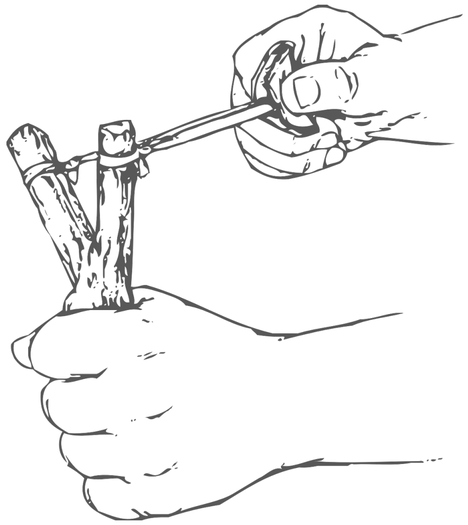
$$U(s, u, \ldots) = \mathrm{Truth}(u, s) - \mathrm{Cost}(u) + \mathrm{Informativity}(u) + \mathrm{politeness}(u) + \ldots$$

PRAGMATIC INTERPRETER

$$P_L(s, \ldots \mid u) \propto P(s)\ P_S(u \mid s, \ldots)$$

this course

Learning goals



1. Ability to understand and critically evaluate current research papers in (pragmatic) NLG.
2. Ability to reproduce (simpler) simulations from the literature.
3. Confidence in critically assessing methodology and manner of reporting in research papers.

Requirements

programming in Python

- necessary: basics of Python
- not presupposed: PyTorch

statistics & neural network

- necessary: linear algebra, probability, regression, simple ANNs
- not presupposed: deep ANNs, LMs

Grading

homework exercises

- individually
- (almost) weekly
- hands-on tasks
- passing grade required to proceed

course project

- groups of 2-3 people
- replication attempt

final grade

- 0.4 * HW + 0.6 * project

Format

- Sessions: Weds 9:00 (st)-11:45
- mix of lecture and guided practice
- exercises begin in class, rest homework
  - joint learning
  - nobody is an expert
  - no honest question is stupid

Preliminary schedule (until XMas)

1. Overview NLG
2. Probabilistic pragmatics
3. Basics of PyTorch
4. Neural language models
5. Pragmatic models of neural NLG
6. Grounded neural language models
7. Pragmatic approaches to grounded NLG

date	topic
Oct 26	overview: course & NLG
Nov 2	pragmatics, reference games, RSA
Nov 9	ANNs, PyTorch
Nov 16	simple LMs
Nov 23	complex LMs, evaluation measures
Nov 30	decoding strategies
Dec 7	visually grounded LMs
Dec 14	pragmatic NLG 1
Dec 21	pragmatic NLG 2

Colloquium talk by **Clara Meister** (Zürich)
Monday November 7th (16:15-17:45)
on **decoding strategies**
https://zoom.us/my/michael.franke.tuebingen

Reproducibility

replication crisis (in empirical sciences)

- large-scale inability to reproduce results reported in published papers

replicability

- ability to replicate reported studies using the same methods but new data collection (using same procedure as in original paper)

reproducibility

- ability to reproduce the results reported in a paper based on the information provided (code, data, method descriptions …)
  - code & data to be available?
  - method descriptions complete and clear?
  - code intelligible, executable (backward compatible) & error-free?
- see Wieling et al (2018) on reproducibility in CL

Homework

- read Gatt & Kramer (2018)
  - focus on sections 1-4
- read Scontras et al (2021)
- if you want local computation:
  - install Python 3.10
  - [optionally] install an IDE
  - install packages
    - numpy, seaborn, pandas, pytorch (…)