

# Why is NLP hard?

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- *Will Will will Will's will?*
- *Rose rose to put rose roes on her rows of roses.*
- *Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo.*  
→ Buffaloes from Buffalo, NY, whom buffaloes from Buffalo bully, bully buffaloes from Buffalo.

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## *Language ambiguity: Structural*

- *The man saw the boy with the binoculars.*
- *Flying planes can be dangerous.*
- *Hole found in the room wall; police are looking into it.*

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- *It is very warm here.*
- *Q: Did your mother call your aunt last night?*  
*A: I'm sure she must have.*

*But that's the fun part of it*

Why is the teacher wearing sun-glasses?

...



*But that's the fun part of it*

Why is the teacher wearing sun-glasses?

...

Because the class is so **bright**.

## *News Headlines*

- Hospitals Are Sued by 7 Foot Doctors
- Stolen Painting Found by Tree
- Teacher Strikes Idle Kids

# *Ambiguity is pervasive*

- Find at least 5 meanings of this sentence:
  - ▶ I made her duck

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- Find at least 5 meanings of this sentence:
  - ▶ I made her duck
- I cooked duck for her
- I cooked duck belonging to her
- I created the (artificial) duck, she owns
- I caused her to quickly lower her head or body
- I waved my magic wand and turned her into a duck

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## *Syntactic Category*

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## *Word Meaning*

- 'make' can mean 'create' or 'cook'

# Ambiguity is pervasive

## Grammar

make can be

- **Transitive:** (verb with a noun direct object)
- **Ditransitive:** (verb has 2 noun objects)
- **Action-transitive:** (verb has a direct object + verb)

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## *Phonetics*

- I'm eight or duck
- I'm aid her duck



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- I saw the man on the hill in Texas with the telescope at noon. **42 parses**

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- I saw the man on the hill in Texas with the telescope at noon. **42 parses**
- I saw the man on the hill in Texas with the telescope at noon on Monday.  
**132 parses**

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  - ▶ permits shorter linguistic expressions
  - ▶ avoids language being overly complex
- Language relies on people's ability to use their knowledge and inference abilities to properly resolve ambiguities

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# Natural Languages vs. Computer Languages

- Ambiguity is the primary difference between natural and computer languages.
- Formal programming languages are designed to be unambiguous
  - ▶ *Formal programming languages can be defined by a grammar that produces a unique parse for each sentence in the language.*
- Programming languages are also designed for efficient (deterministic) parsing.

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Great job @justinbieber! Were SOO PROUD of what youve accomplished! U taught us 2 #neversaynever & you yourself should never give up either



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## *Segmentation Issues*

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- dark horse
- Ball in your court
- Burn the midnight oil

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- dark horse
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- Burn the midnight oil

## *neologisms*

- unfriend
- retweet
- Google/Skype/photoshop

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## *New Senses of a word*

- That's *sick* dude!
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## *Tricky Entity Names*

- Where is *A Bug's Life* playing ...
- *Let It Be* was recorded ...



# *What we do in NLP?*

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  - ▶  $P(\text{"maison"} \rightarrow \text{"house"})$  is high

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  - ▶  $P(\text{"maison"} \rightarrow \text{"house"})$  is high
  - ▶  $P(\text{I saw a van}) > P(\text{eyes awe of an})$
- Extracting rough text features does half the job.