

A few applications of natural language processing...

- Spelling correction, grammar checking ...
- Better search engines
- Information extraction
- Psychotherapy; Harlequin romances; etc.
- New interfaces:
 - Speech recognition (and text-to-speech)
 - Dialogue systems (USS Enterprise onboard computer)
 - Machine translation (Babel fish)

Levels of Language

- **Phonetics/phonology/morphology:** what words (or subwords) are we dealing with?
- **Syntax:** What phrases are we dealing with? Which words modify one another?
- **Semantics:** What's the literal meaning?
- **Pragmatics:** What should you conclude from the fact that I said something? How should you react?

Ambiguity: Favorite Headlines

- Iraqi Head Seeks Arms
- Juvenile Court to Try Shooting Defendant
- Teacher Strikes Idle Kids
- Stolen Painting Found by Tree
- Kids Make Nutritious Snacks
- Local HS Dropouts Cut in Half
- Obesity Study Looks for Larger Test Group

Ambiguity: Favorite Headlines

- British Left Waffles on Falkland Islands
- Never Withhold Herpes Infection from Loved One
- Red Tape Holds Up New Bridges
- Man Struck by Lightning Faces Battery Charge
- Clinton Wins on Budget, but More Lies Ahead
- Hospitals Are Sued by 7 Foot Doctors

Text understanding is very hard

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But it turned out to be too expensive there.

- NL *relies on* ambiguity! (Why?)
- “We haven’t had a sale in 40 years”

What’s hard about the story?

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But it turned out to be too expensive there.

To get a donut (spare tire) for his car?

What's hard?

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But it turned out to be too expensive there.

store where donuts shop? or is run by donuts?
or looks like a big donut? or made of donut?
or has an emptiness at its core?

(Think of five other issues...there are lots)

What's hard about this story?

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But it turned out to be too expensive there.

Describes where the store is? Or when he stopped?

What's hard about this story?

John stopped at the donut store on his way home **from work**. He thought a coffee was good every few hours. But it turned out to be too expensive there.

Well, actually, he stopped there from hunger and exhaustion, not just from work.

What's hard about this story?

John stopped at the donut store on his way home from work. **He thought** a coffee was good every few hours. But it turned out to be too expensive there.

At that moment, or habitually?

(Similarly: Mozart composed music.)

What's hard about this story?

John stopped at the donut store on his way home from work. He thought a coffee was good **every few hours**. But it turned out to be too expensive there.

That's how often he thought it?

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What's hard about this story?

John stopped at the donut store on his way home from work. He thought **a coffee was good every few hours**. But it turned out to be too expensive there.

But actually, a coffee only stays good for about 10 minutes before it gets cold.

What's hard about this story?

John stopped at the donut store on his way home from work. He thought *a coffee was good every few hours*. But it turned out to be too expensive there.

But actually, a coffee only stays good for about 10 minutes before it gets cold.

What's hard about this story?

John stopped at the donut store on his way home from work. He thought *a coffee was good every few hours*. But it turned out to be too expensive there.

Similarly: (Groucho Marx): In America a woman has a baby every 15 minutes. Our job is to find that woman and stop her.

What's hard about this story?

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But **it** turned out to be too expensive there.

the particular coffee that was good every few hours? the donut store? the situation?

What's hard about this story?

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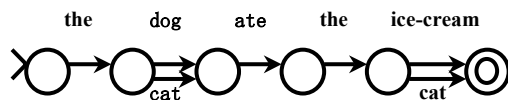
What's hard about this story?

John stopped at the donut store on his way home from work. He thought a coffee was good every few hours. But it turned out to be **too expensive** there.

too expensive for what? what are we supposed to conclude about what John did?
how do we connect “it” to “expensive”?

Syntax = string patterns

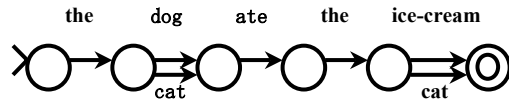
The dog ate the ice-cream
The cat ate the ice-cream
The dog ate the cat



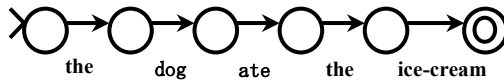
Start
state

end
state

Syntax as linear patterns (syntactic transition 'tree')



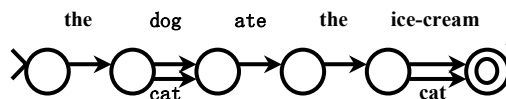
"the dog ate the ice-cream"



Success!!

From syntax to 'meaning' = don't just speak, do something

The dog ate the ice-cream
The cat ate the ice-cream
The dog ate the cat



Start
state

end
state

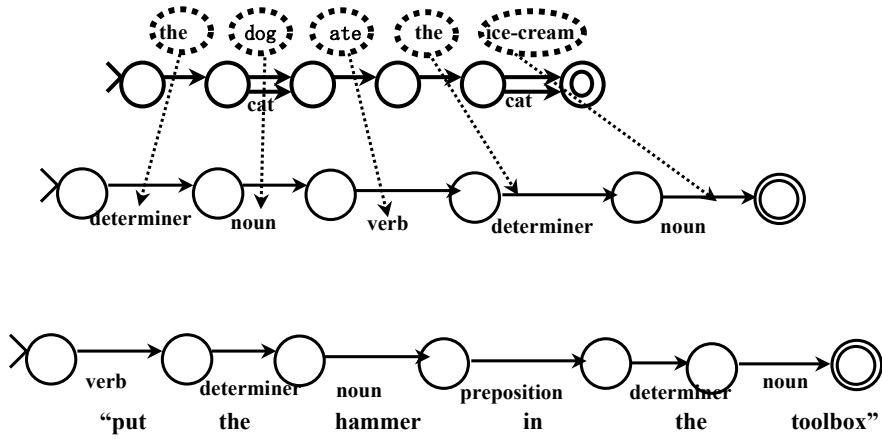
(lookup (?x ate ?y))

Action!!

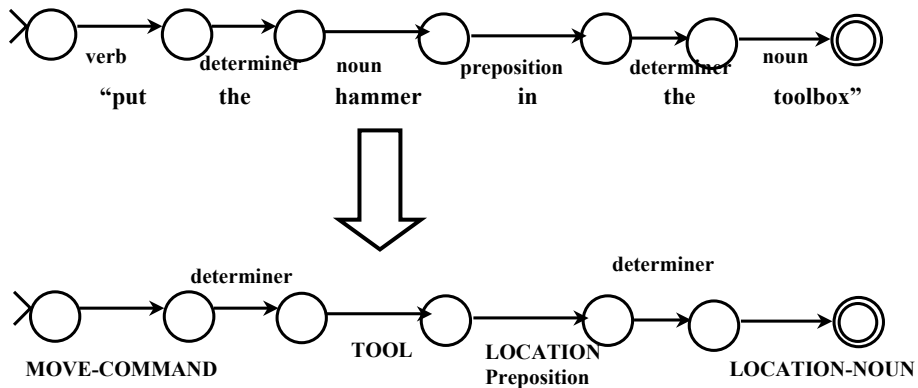
database

Ans:
Yes

Generalize to word categories...



From syntactic nets to semantic nets...

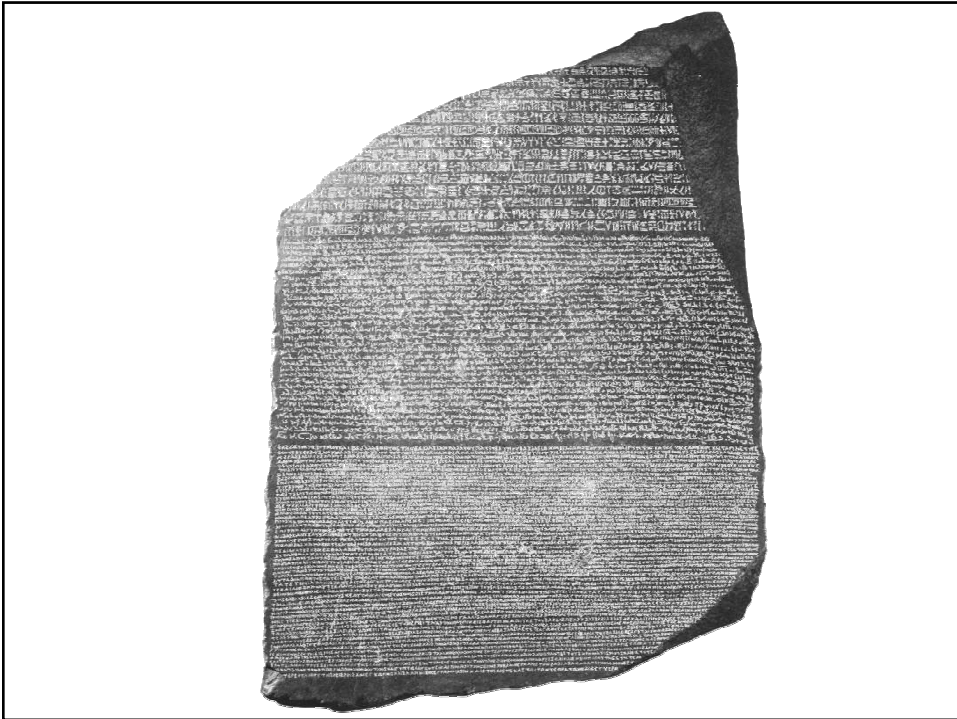


The Full Monty

- “My hovercraft...
is full of eels”
- Hungarian: “Can you direct me to the railway station?”
- [...censored...]
- Mi aerodeslizador es lleno de anguilas
- Where is the men’s room?
- ¿Dónde está el cuarto de los hombres?

A few more idioms...

- Out of sight, out of mind
- 心からの視力から,
- From vision to heart
- Famous MT – on mag tape – to Russian:
Из визирования, из разума
From the sighting, from the reason



Alien languages: Alpha-centauri & Betelgeuse

- 1a. ok-voon ororok sprok . 2a. ok-drubel ok-voon anak plok sprok .
1b. at-voon bichat dat . 2b. at-drubel at-voon pippat rrat dat .
- 3a. erok sprok izok hihok ghirok . 4a. ok-voon anak drok brok jok .
3b. totat dat arrat vat hilat . 4b. at-voon krat pippat sat lat .
- 5a. wiwok farok izok stok . 6a. lalok sprok izok jok stok .
5b. totat jjat quat cat . 6b. wat dat krat quat cat .
- 7a. lalok farok ororok lalok sprok izok enemok .
7b. wat jjat bichat wat dat vat eneak .
- 8a. lalok brok anak plok nok . 9a. wiwok nok izok kantok ok-yurp
8b. iat lat pippat rrat nnat . 9b. totat nnat quat oloat at-yurp
- 10a. lalok mok nok yorok ghirok klok .
10b. wat nnat gat mat bat hilat .
- 11a. lalok nok crrrok hihok yorok zanzanak .
11b. wat nnat arrat mat zanzanat .
- 12a. lalok rarok nok izok hihok mok .
12b. wat nnat forat arrat vat gat .

In the words of Babelfish

- If you cannot strike it, connect them