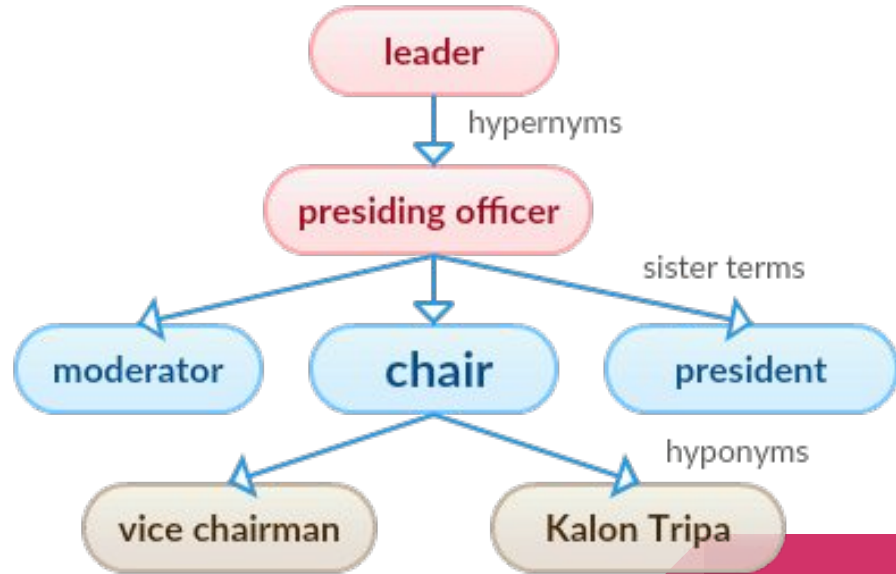# Structural Linguistics 3: the *meaning*

Mariana Romanyshyn, *Grammarly, Inc.*

Contents

A word is its...

1. form
2. function
3. *meaning*

1. Units of meaning

Meaning

- *Lexeme*
  - a word in all of its forms
  - can be divided into *morphemes*

Meaning

- *Lexeme*
  - a word in all of its forms
  - can be divided into *morphemes*

- *Sememe*
  - each individual meaning of a word
  - can be divided into *semes*

Semes

- **Walk** - to <u>move forwards</u> <u>using your legs and feet</u>
- **Run** - to <u>move forwards</u> quickly <u>using your legs and feet</u>

- **Boat** - a small <u>vessel</u> for travelling <u>over water</u>
- **Ship** - a large <u>vessel</u> for transporting people or goods <u>by sea</u>

Semes in polysemous words

- **Read**
  - *(a book)* to look at and understand written words
  - *(music)* to understand the written marks that represent musical sounds
  - *(a situation)* to understand something in a particular way

Semes in polysemous words

- *Пити*
  - ковтати яку-небудь рідину для вгамування спраги
  - вживати спиртне
  - вбирати в себе вологу

Polysemy vs Homonymy

- Homonymous *"bank"*
  - a financial institution
  - an area of land along the side of a river

- Polysemous *"man"*
  - the humanity
  - male part of the humanity
  - adult male part of the humanity

Polysemy vs Homonymy

- Homonymous *"bank"*
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- Polysemous *"man"*
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  - male part of the humanity
  - adult male part of the humanity
  - ~~a person~~

Is it serious?

- ~40% of English words are polysemous
- most polysemous - verbs (~55%)
- resources disagree
  - *"head"* has 10-40 meanings in different dictionaries
- solved by word sense disambiguation algorithms (e.g., Babelfy)

DADDY, I WANT A PONY!

SPOILED MILK

2. Lexical Semantics

Lexical semantic relations

- Synonyms - share the same (or similar) meaning
  - *big house - large house*
  - *великий мороз - сильний мороз*

- Antonyms - have the opposite meaning
  - *big house - small house*
  - *велика сім'я - маленька сім'я*

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Lexical semantic relations

- Hypernym - a more generic term
- Hyponym (for verbs: troponym) - a more specific term

  - *couch => bed => bedroom furniture => furniture*
  - *trot => run => move*
  - *викрутка => інструмент <= молоток*

Lexical semantic relations

- Hypernym - a more generic term
- Hyponym (for verbs: troponym) - a more specific term

  - *Mom is slicing an eggplant. => A woman is cutting a vegetable.*

Lexical semantic relations

- Meronym - a part or a member of something
- Holonym - the whole

  - *car => bumper, seat, door, window, engine, etc.*
  - *eye => eyelid, eyeball, iris, pupil, etc.*
  - *faculty => professor*
  - *water => oxygen*

Lexical semantic relations

- Entailment - X entails Y if X cannot be done unless Y is done.
  - *snore => sleep*
  - *listen => hear*
  - *buy => sell*
  - *молодший => старший*
  - *ліворуч => праворуч*
  - *винахід => винахідник*

Lexical semantic relations

- Entailment - X entails Y if X cannot be done unless Y is done.
  - *Учора ми витратили останні гроші. => Учора в нас закінчилися всі гроші.*
  - *Іра розмовляє з Іваном. => Іван розмовляє з Ірою.*
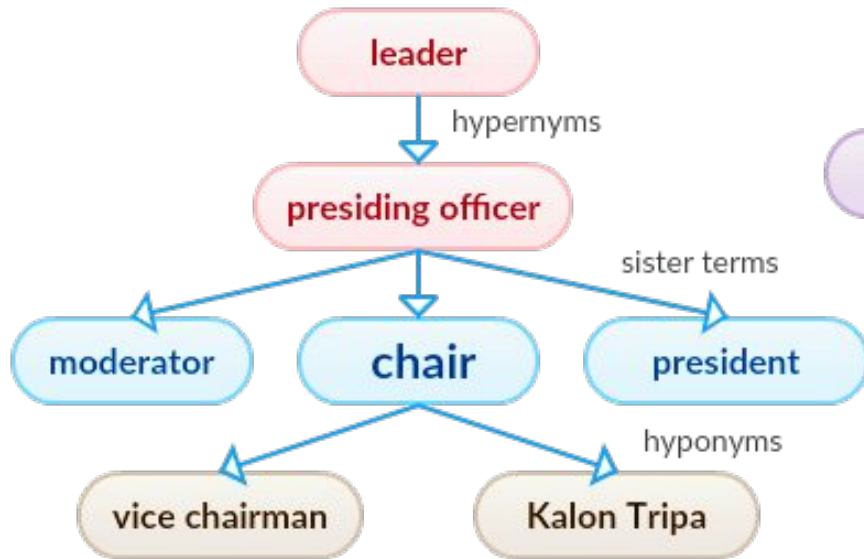 - *Іра говорить до Івана. !=> Іван говорить до Іри.*

Lexical semantic resources

- Thesauri
  - word level
  - synonyms, antonyms, related terms

- Ontologies
  - concept level
  - lexical semantic relations

WordNet *(... and many more)*
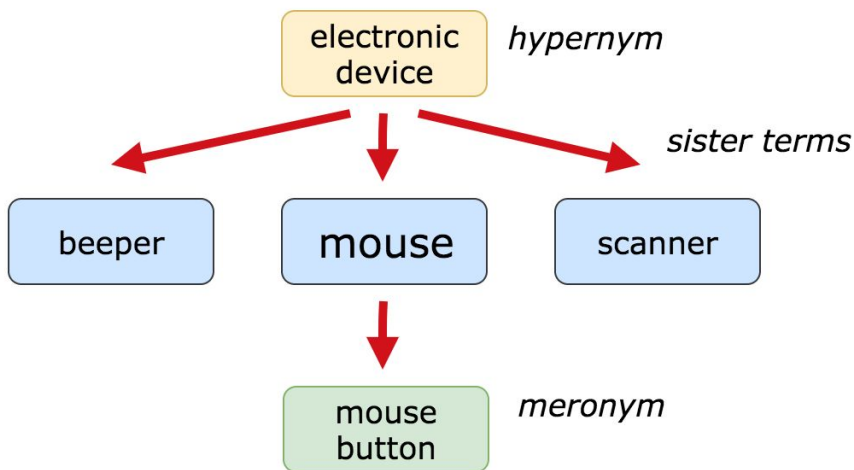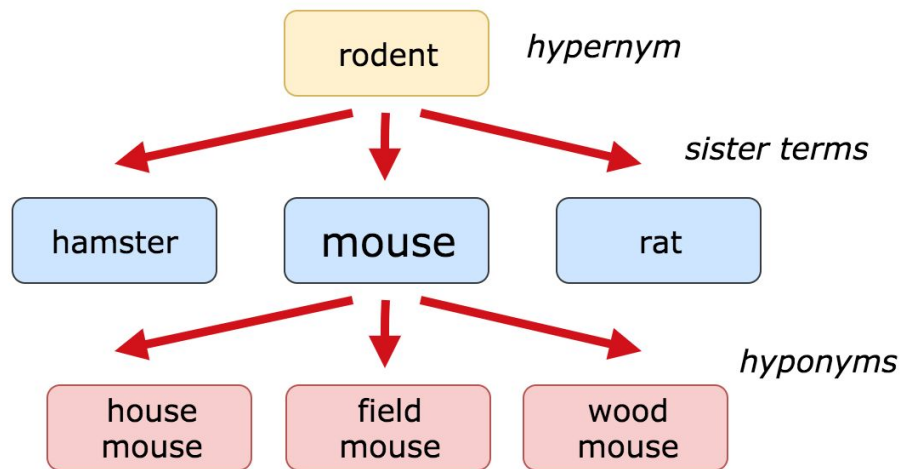
WordNet *(… and many more)*
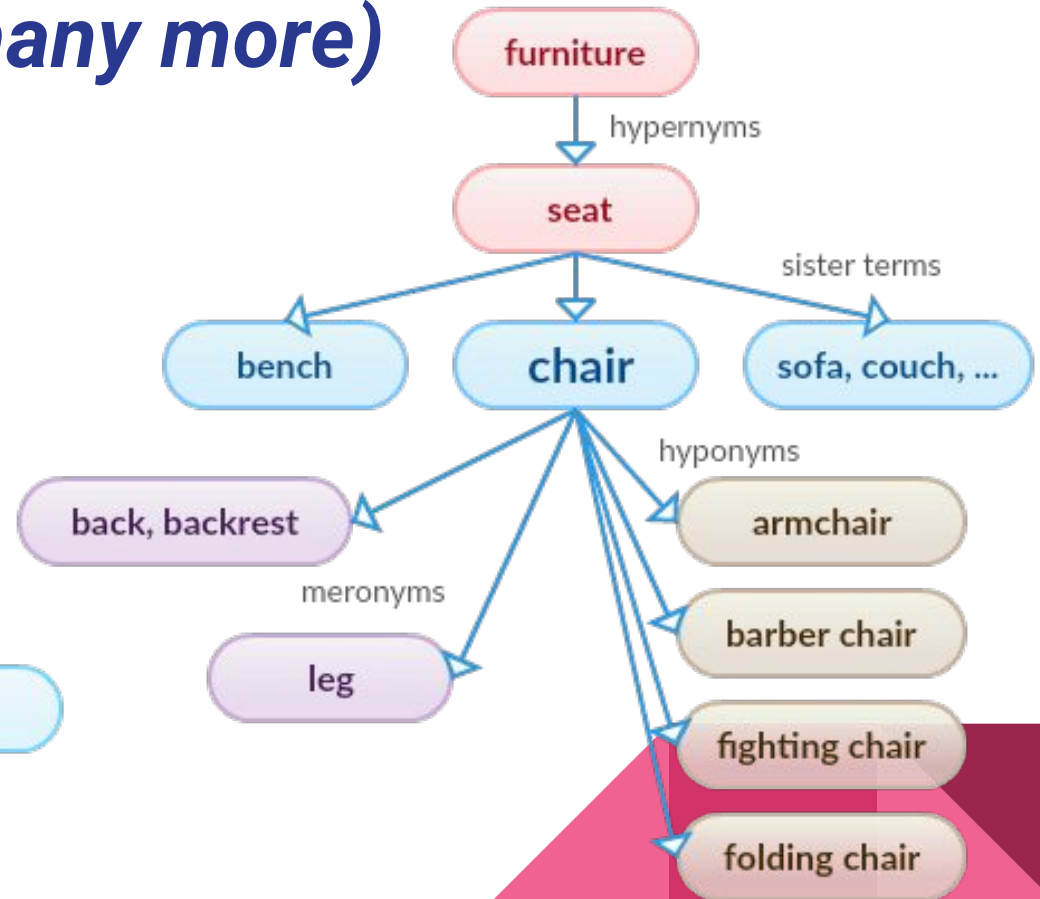
Usage in NLP

- Word sense disambiguation
- Information retrieval
- Question answering
- Textual entailment
- Error correction
- Text classification
- Paraphrasing/deduplication
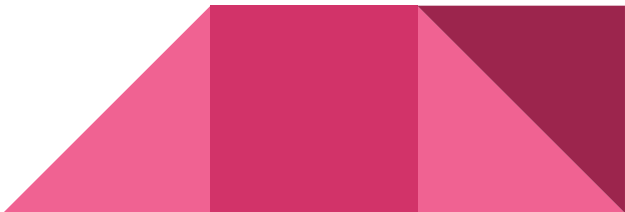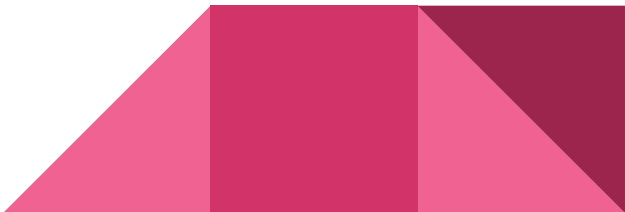- and any other NLU task

3. Semantic Analysis

Semantic Analysis

- Semantic role labelling
  - *a.k.a. shallow semantic parsing*
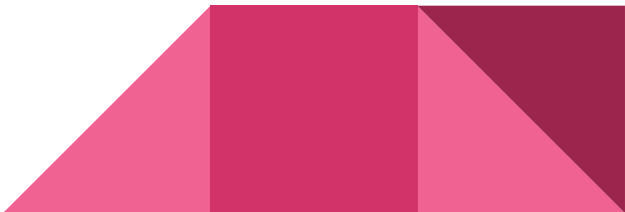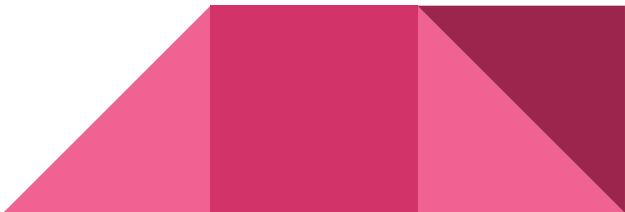- Semantic parsing
  - *language as a graph*

Who did what to whom?

- *TimTim sued TomTom for $13 mln.*

- *TimTim filed a lawsuit against TomTom for $13 mln.*

- *TomTom was sued for the breach of agreement.*

- *TomTom paid $13 mln in a lawsuit filed by TimTim.*

- *TimTim dragged TomTom into court for the breach of agreement.*

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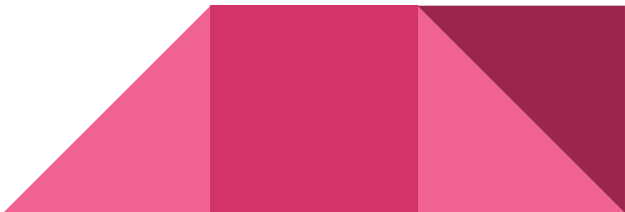- *TimTim <u>dragged</u> TomTom <u>into court</u> for the breach of agreement.*

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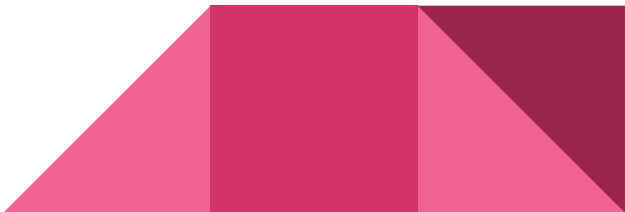- *TimTim dragged TomTom into court for the breach of agreement.*

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Semantic Roles

- Causer: Agent (acts consciously) or Force
  - **Kim** *signed the letter.*
  - **The rain** *ruined the crops.*

- Instrument
  - *Kim cut the cake with **the knife**.*

- Result (appears in the process)
  - *They made **a hole** in the roof.*

Semantic Roles

- Patient (animate, affected by the action)
  - *Kim kicked **the little boy**.*
  - *John finally kissed **her**.*

- Theme (affected by the action and changed)
  - *He gave me **the key**.*
  - ***The letter** was signed by Kim.*
  - ***She** woke up.*

Semantic Roles

The Theme can change the location (in space or time), the owner, its properties, etc.

- Source, path, goal/recipient, location
  - *She ran from **the post office** down **the Main Street** to the **bus stop**.*
  - *The meeting is at **noon**.*
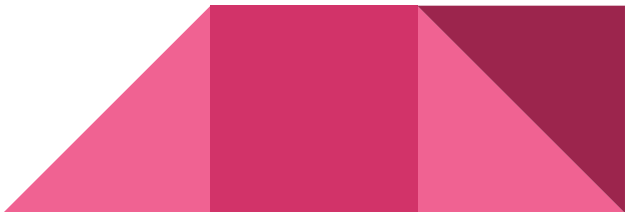 - *He gave **me** the key.*

Semantic Roles

- Experiencer (feels or perceives)
  - **We** *heard a bang.*

- Stimulus (arouses a feeling or is perceived)
  - *We heard a **bang**.*

- Beneficiary (obtains sth or for whom sth is done)
  - *I bought **you** a present.*

Practice

- *The hurricane produced a 25-foot storm surge on Martinique, which destroyed all houses in Saint-Pierre.*

- *The police officer kept the suspect at the station.*

- *This thought scares me.*

- *I have to make reservations for my boss.*

- *The robbers stole money from my house.*

VerbNet

- Verb group:
  - *deal, lend, loan, pass, peddle, refund, render*
- Syntactic frames:
  - *"NP V NP PP.recipient"*
  - *"NP V NP-Dative NP"*
  - *"NP V NP"*
  - *"NP V PP.recipient"*

PropBank

- *increase.01 "go up incrementally"*
  - *Arg0: causer of increase*
  - *Arg1: thing increasing*
  - *Arg2: amount increased by*
  - *Arg3: start point*
  - *Arg4: end point*
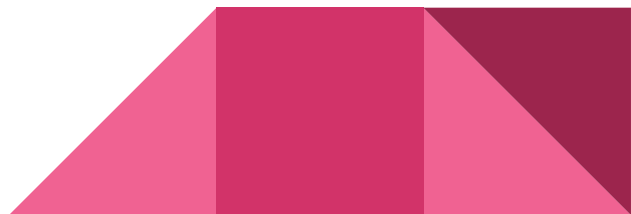- **The government** *increased* **taxes** *by* **5%***.*
- **Taxes** *increased.*

PropBank

PropBank

|		
TMP	when?	yesterday evening, now
LOC	where?	at the museum, in San Francisco
DIR	where to/from?	down, to Bangkok
MNR	how?	clearly, with much enthusiasm
PRP/CAU	why?	because ... , in response to the ruling
REC		themselves, each other
ADV	miscellaneous	
PRD	secondary predication	...ate the meat raw

FrameNet

- Abandonment**:**
  - *abandon, abandoned, abandonment, leave, forget*
- An **Agent** leaves behind a **Theme** effectively rendering it no longer within their control or as one's property…
- examples:
  - **Carolyn** *abandoned* **her car** *and jumped on a bus.*
  - *Abandonment of* **a child** *is considered to be a serious crime in many jurisdictions.*
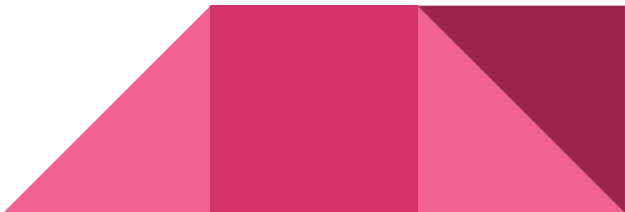 - *Perhaps* **he** *left* **the key** *in the ignition.*

Abstract Meaning Representation

I beg you to excuse me.
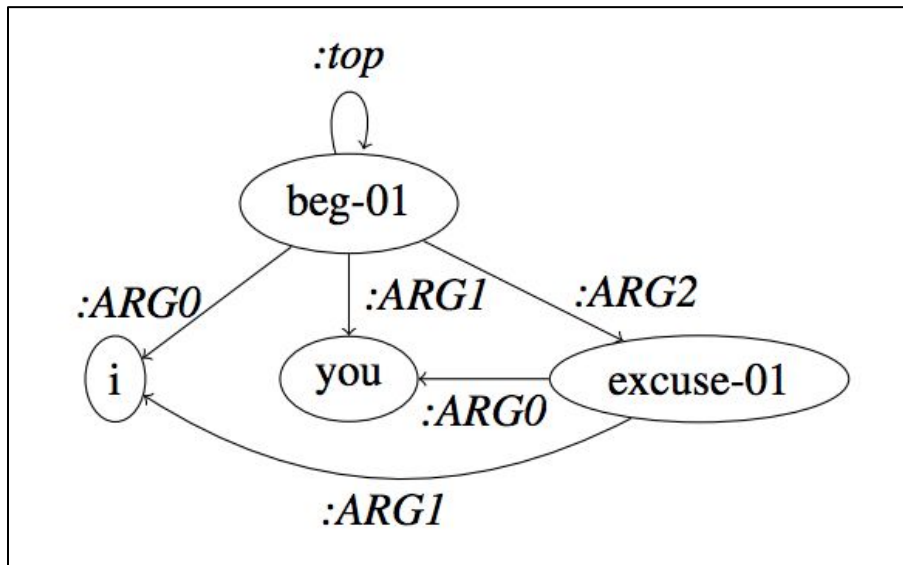
Usage in NLP

- Natural Language Understanding tasks:
  - Information retrieval
  - Event extraction
  - Question answering
  - Textual entailment
  - Paraphrasing/deduplication

Questions?