ELL101: Intro to Linguistics
Week 8-9 Semantics

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Introduction: Semantics I

- Why semantics is important (from (Pinker, 2007))

- How many events did take place in New York on September 11, 2001?
  - One event that was conceived in the mind of one man in service of a single agenda. (which led a single chain of military and political events in their aftermath)
  - Two repeated events in which the north tower and the south tower were distinct collection of glass and steel separated by an expanse of space, and they were hit at different times.

Introduction: Semantics II

- Was 9/11 an one event? or Were 9/11 two events?

- Your answer may be ”who cares?”. However, it is one of the most controversial questions disputed in the court.

- Larry Silverstein, the leaseholder of the World Trade Center site, held insurance policies that stipulated a maximum reimbursement for each destructive **event** – 3.5 billion dollars for each **event**.
  - If there was only one event, the leaseholder will receive $3.5 billion of indemnification
  - If there were two events, the leaseholder will receive $7 billion of indemnification.

- The study of semantics = **3.5 billion dollars at stake**

Introduction: Semantics III

- What's happened?

- Twenty-four insurance companies appealed to the court for the "one occurrence" interpretation.

- A series of trials resulted in a verdict on that...
  - Fourteen of the insurers were subject to the "one occurrence" interpretation
  - Ten of the insurers were subject to the "two occurrences" interpretation (those companies are liable for a double the face value of their policies ($2.2 billion $\times$ 2!!))

Introduction::Semantics I

- Grammatical elements (surface elements)
  - affixization (i.e., prefix, infix, suffix)
  - grammatical words (e.g., preposition, conjunction, auxiliary verbs etc.)
  - light verbs (e.g., *make, do, be, have, take, go* etc.)

- Grammatical elements must match meaning elements (i.e., when you hear a sentence/structure, you understand its meaning)

Subfields of Semantics I

Semantics

The study of meaning in language (e.g., what does ”event” mean?) (Yule, 2010)

Two different types of meanings

- **Conceptual Meaning**
  Literal, direct meaning of words and phrases (e.g., *needle* = ”thin, sharp, steel instrument”)
- **Associative Meaning**
  Meaning associated with words based on our experience. (e.g., *needle* = ”pain”, ”illness”, ”blood”, ”drugs”, ”knitting”, ”hard to find” etc.)

Subfields of Semantics II

Subfields of Semantics

- **Lexical Semantics**
  Meaning of individual words (e.g., *cup*)
- **Compositional Semantics**
  The way that the meaning of the whole sentence are determined from the meanings of the words in them (via syntactic structures of the sentence) (e.g., *a container that holds liquid*)

Related fields

Pragmatics

Language meaning as a social phenomenon (implicit agreements between the speaker and the listener in a community)

Philosophy

The study of the fundamental nature of knowledge, reality and existence

Cognitive Psychology

The scientific study of thought, learning, and mental organization

Law/Jurisprudence

President George Bush's State of the Union address in January 2003
"*The British government has learned that Saddam Hussein recently sought significant quantities of uranium from Africa.*" – Did he lie or not?

The goal of semantics

Goal of semantics

How do we (human beings) know the meaning of words, phrases, and sentences? For example,

- How do we know the difference between "*Not everyone likes linguistics.*" and "*Everyone doesn't like linguistics.*"?
- How do we know what *dog* means? How do you define *dog*? Maybe, a four-legged mammal that barks? Then, what about dogs with only three legs or that never bark? Are they still dogs or not?
- How do we distinguish a *dog* from a *horse*? How does a child know such distinctions?
- How did we learn what *event* is? Who taught us? How about other conceptual words such as *love*, *happiness*, *beauty* etc.

Lexical & Compositional semantics I

Lexical semantics

Lexical semantics deals with the meanings of individual words

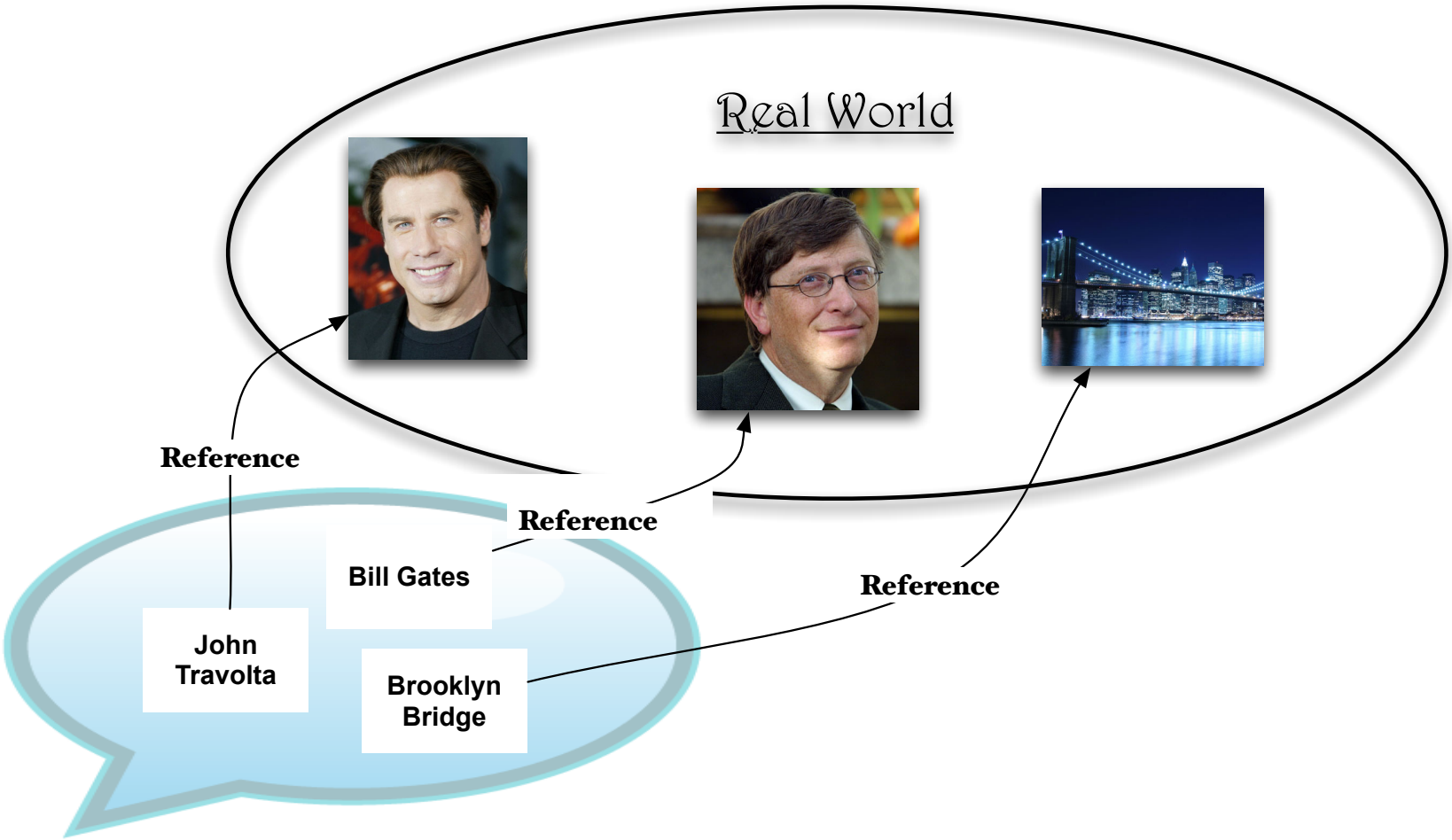
Compositional semantics

Compositional semantics deals with the meanings of words/phrases

- We take it for granted that language means something. But what does it really mean to mean something?

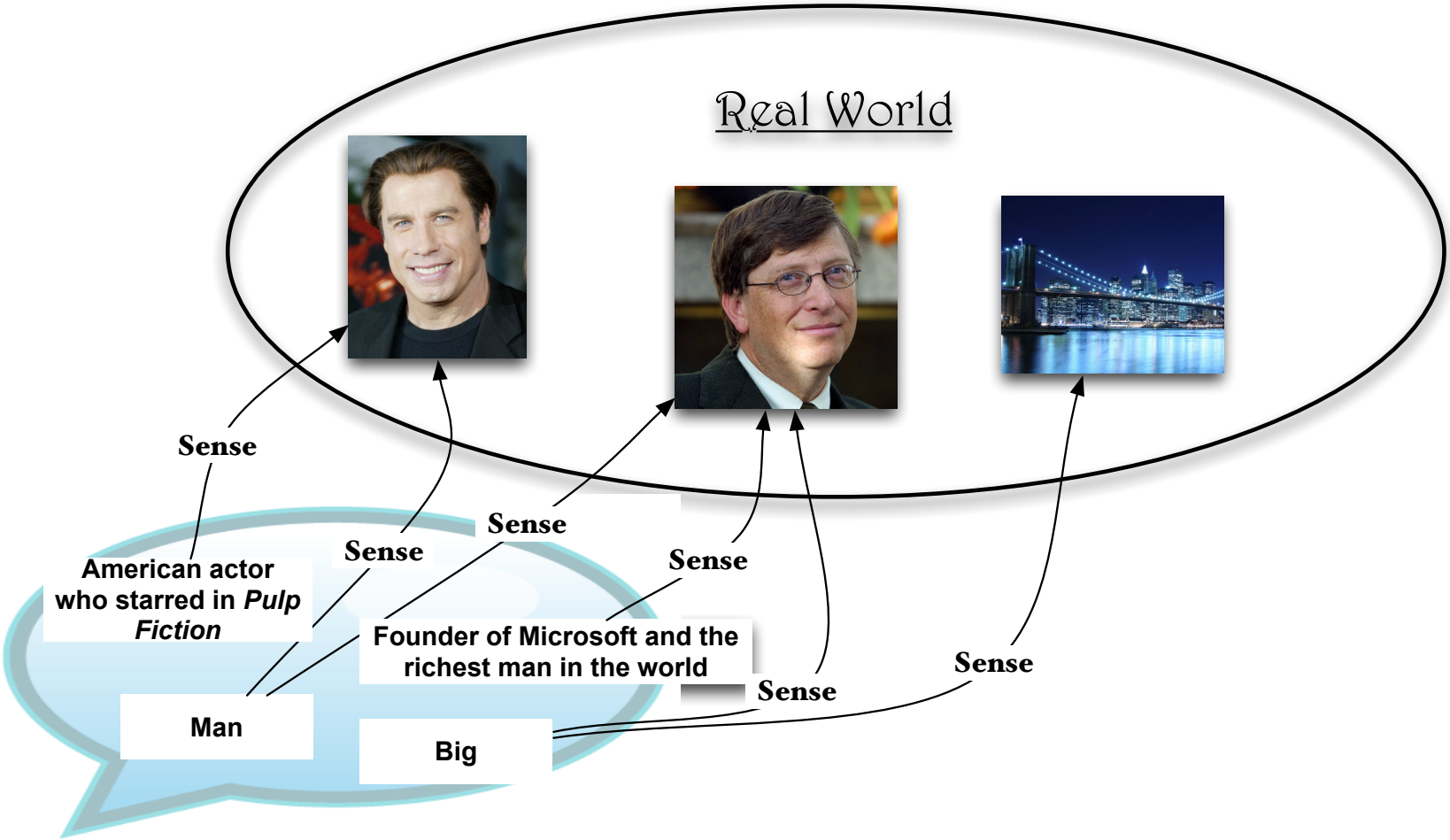
Lexical & Compositional semantics II

- One-to-one mapping between language utterances and objects in the real world? (sense and reference)



Lexical & Compositional semantics III

- Okay... it works with proper nouns. What about common nouns (such as *male*) and adjectives (such as *big*)?



Lexical & Compositional semantics IV

- Does it mean we need billions of references for *male*? Also, does it mean Bill Gates cannot be *big*?
- The mapping between language and the real world is arbitrary (there is no reason to call John Travolta *John Travolta*; his name could have been *Bill Gates*)
- Due to this duel layer of language meaning, we can express utterances that are logically impossible: *the largest integer*, *an adult baby*, *a true lie*
- I hope that four years later **the president of the USA** is a woman.
  - the president of the USA = Barack Obama
  - I hope that four years later **Barack Obama** is a woman.

Lexical & Compositional semantics V

- ”*The Elders of Chelm and Genedel's Key*” (Yiddish folklore; from Pinker (2007))

  In a mythical town of fools, there has been a shortage of sour cream that imperils the celebration of a holiday on which blintzes are eaten. The elders came up with an idea: ”Let us make a law that water is to be called sour cream and sour cream is to be called water. Since there is a plenty of water in the wells of Chelm, each housewife will have a full barrel of sour cream. There will be a lack of 'water', but it is an entirely new problem that can be solved after the holiday.”

Lexical & Compositional semantics VI

- What about the dictionary-style definitions?
- Deception of the dictionary: ”Dictionary” does not manifest definite meanings of the word. It is an authoritative reference for convenience.
- Let’s look up the word ”divine” and ”deity”
  - ”divine” - being or having the nature of **deity**
  - ”deity” - **divine**
- Let’s look up the word ”pride” and ”proud”
  - ”pride” - the quality of state of being **proud**
  - ”proud” - keeping or showing **pride**
- The definitions in the dictionary are circularly
- The word meaning is determined by the people who use that word, not by a dictionary

Lexical & Compositional semantics VII

- We know that meanings defined by words is iffy. Thus, our goal is to define ”meanings” of language without relying on the language. (for example, we want to talk about the meaning of *red* without using the term ”red” or any language.)

Lexical semantics: synonymy I

Synonymy

Two or more words with very closely related meanings. They are often interchangeable. (cf. synonyms)

- almost - barely, big - large, broad - wide, buy - purchase, cab - taxi, car -automobile, couch - sofa (and now futon), freedom - liberty

Lexical semantics: synonymy II

Antonymy

The opposite meaning.

Complementary/Contrary antonym

Given two words X and Y, if every entity in the world is either in X's set or Y's set, but not in both

- e.g., married - unmarried, visible - invisible. dead - alive, male - female, true - false

Lexical semantics: synonymy III

Relational/Gradable antonym

X and Y are relational opposite if everything in the world is either in X's set, in Y's set, or in neither, but not in the both sets

- e.g., over - under, easy - hard, old - young, fast - slow

Reverse

Pairs of words that suggests some kind of movement, where one word in the pair "undoes" the other word.

- e.g., dress - undress, inside - outside, expand - contract, ascent - decent, enter - exit, pack - unpack

Lexical semantics: synonymy IV

Scalar antonym

The relational antonym that can be seen as endpoints on some scale (e.g., of temperature, size, height, age etc.)

- e.g., warm / hot / scorching - cold / freezing / chilly / large / big / gigantic - tiny / small / miniature

Converse

The two opposing points of view.

- e.g., lend - borrow, send - receive, employer - employee, over - under

Lexical semantics: synonymy V

Hyponymy

- The meaning of one form is included in the meaning of another.
- Word X is a hyponym of word Y if, in all possible scenarios, X's set is always contained (is always a subset of) Y's set.
- "the loss of specificity"
- "is kind of" relation
- The opposite of hyponym is *hypernym* (a larger set)

- e.g., animal - dog, dog - poodle, vegetable - carrot, flower - rose, tree - banyan etc...

Lexical semantics: synonymy VI

Metonym

- The meaning of one form is pat of the other form.
- ”is part of” relation
- ”is contained by” relation
- ”is symbolized by” relation

- e.g., wheel - car, roof - house, water - bottle, juice - can, crown - king, the White House - the President etc.

Lexical semantics: synonymy VII

Homophones

Two or more (written) forms have the same pronunciation (but different meanings)

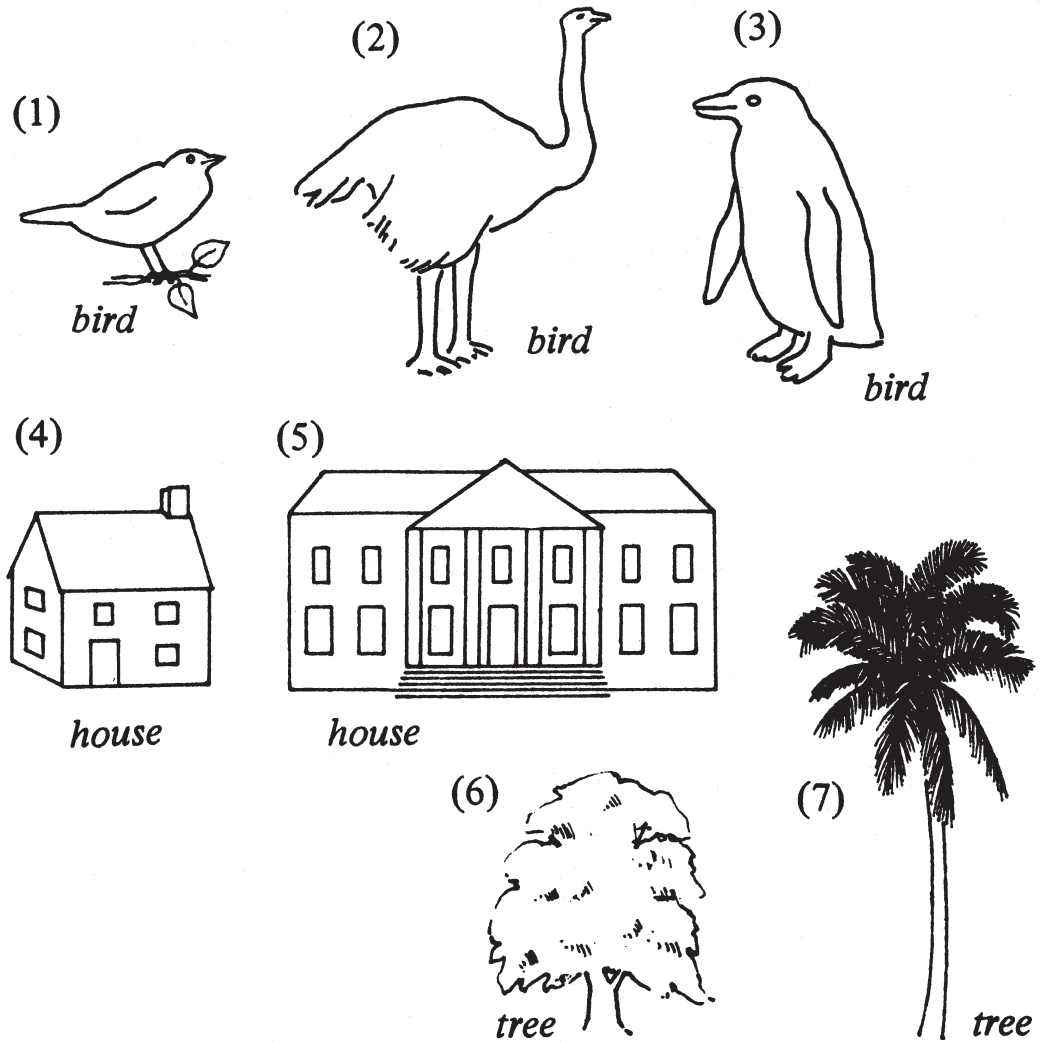
- e.g., bare - bear, meat - meet, flour - flower, pail - pale, right - write, sew - so, to - too - two

Homonyms (ploysemy)

One (written or spoken) form has two or more unrelated meanings

- e.g., bank (of a river) - bank (financial institute), bat (flying creature) - bat (used in sports), mole (of skin) - mole (small animal), pupil (at school) - pupil (in the eye)

Lexical semantics: synonymy VIII



Lexical semantics: synonymy IX

Prototype

An entity that shows the most characteristic instance of the category. (i.e., the thing that comes to your mind when you hear the category)

- e.g., ”robin” is a prototype of ”bird” / ”desk” or ”chair” is a prototype of ”furniture”

Lexical semantics: synonymy X

Collocations

A collocation is a sequence of words that are not compositional (the meaning of the whole is not predictable from its part)

	minority	majority	amount	number	percentage	quantity	importance	significance
small								
little								
large								
great								
big								
high								
wide								

Lexical semantics: synonymy XI

	minority	majority	amount	number	percentage	quantity	importance	significance
small	√		√	√	√	√		
little							√	√
large	√	√	√	√	√	√		
great							√	√
big								
high					√			
wide								

- The meaning of a collocation is not predictable from its part
  - powerful computer
  - heavy oder
  - unshakable faith
  - firm belief
  - competitive game
- Why do we use collocations? Why cannot we use the word ”strong” instead?

Semantic ambiguity

Semantic ambiguity

Ambiguity derived from the semantic property of words (cf. scope ambiguity of quantifiers)

- A man robbed the bank. (either the financial institute or the slope-down along the river)
- My mouse is dead. (either the computer equipment or your pet)
- Someone likes everyone.
- Three boys danced with two girls.
- Everyone likes someone.

θ-roles (thematic roles) I

- Which of the following sentences share the same truth condition?
  - Taro killed Hanako.
  - Hanako killed Taro.
  - Taro died.
  - Hanako died.

θ-roles (thematic roles) II

- Although they share the same truth condition, the syntactic configuration (that is, SUBJECT, OBJECT, and OBLIQUE) are different.
- Those two sentences are of the same condition
  - Taro killed Hanako. (SUB = Taro, OBJ = Hanako)
  - Hanako died. (SUB = Hanako)
- Those two sentences are of the same condition
  - Hanako killed Taro. (SUB = Hanako, OBJ = Taro)
  - Taro died. (SUB = Taro)
- Syntactic configuration (SUBJECT, OBJECT, and OBLIQUE) alone cannot explain the semantic interpretation of the sentence. In order to capture this phenomenon, we will use semantic labels that are independent of syntactic structure.

θ-roles (thematic roles) III

- **Agentive** (A): the case of the typically animate perceived instigator of the action identified by the verb.
- **Instrumental** (I): the case of the inanimate force or object causally involved in the action or state identified by the verb.
- **Locative** (L): the case which identifies the location or spatial orientation of the state or action identified by the verb.
  - **Goal** (G): the case which identifies the direction or spatial goal of the action identified by the verb.
  - **Source** (S): the place from which something moves or appear
- **Theme** (T): the force or resistance against which the action is carried out (a thing undergoes some change as a result of the action denoted by a verb)
- **Experiencer** (E): the entity which receives or accepts or experiences

θ-roles (thematic roles) IV

- Cathy ate pizza.
  - Cathy = AGENT, pizza = THEME
- Eric built a house.
  - Eric = AGENT, a house = THEME (RESULT)
- John threw a ball to a window.
  - John = AGENT, a ball = THEME, a window = GOAL
- Kevin felt sick.
  - Kevin = EXPERIENCER
- She cleaned the wound with an antiseptic wipe.
  - she = AGENT, the wound = THEME, an antiseptic wipe = INSTRUMENT
- The plane came back from Kinshasa.
  - the plane = THEME, Kinshasa = SOURCE

θ-roles (thematic roles) V

- Subject may not always be AGENT
  - Ursula broke the ice with a pickaxe.
  - The pickaxe broke the ice.
  - The ice broke.

θ-roles (thematic roles) VI

- AGENT & THEME
  - The boy kicked the ball.
  - The wind blew the ball away.
  - A car ran over the ball.
  - The dog caught the ball.
  - The children broke the vase.
  - The ball was kicked by the boy.
  - The ball blew away.
  - The vase broke.

θ-roles (thematic roles) VII

- INSTRUMENT & EXPERIENCER
  - The boy cut the rope with an old razor.
  - He drew the picture with a crayon.
  - The boy feels sad.
  - Did you hear that noise.
  - I saw the elephant with the binocular.
  - Cathy open the door with her key.
  - The door was opened with the key.
  - This key opened the door.

θ-roles (thematic roles) VIII

- LOCATIVE, SOURCE, & GOAL
  - Mary saw a fly on the wall.
  - She borrowed a magazine from George.
  - She squashed the bug with the magazine.
  - This new train runs from Atlantic City to New York.
  - She handed the magazine back to George.
  - This bag is made of vinyl.
  - A famous diamond from India is stolen
  - The class was held in the lab today.

θ-roles (thematic roles) IX

- What are the θ-roles of the underlined arguments?
  - Eve bit an apple.
  - Diamonds were given to Ruby.
  - Mary waited until noon.
  - Bob went to Danbury.
  - The truck was serviced for 5 hours.
  - The tree produced new leaves.
  - Yojo sees the fish.
  - The key opened the door.
  - Vehicles arrive at a station.

θ-roles (thematic roles) X

- Bill told Boris by phone.
- The package was shipped via Albany.
- The cat swallowed the canary.

Entailment I

Entailment

Sentence **A** entails Sentence **B** if Sentence **B** is always true in all possible scenarios of Sentence **B**.

- For example,
  - Corday assassinated Marat.
  - Marat is dead.

  For the first sentence to be true, the second sentence should always be true. Thus, the first sentence entails the second sentence. Other examples are
  - The brick is red $\rightarrow$ The brick is not white.
  - Mortimer is a bachelor. $\rightarrow$ Mortimer is male.
- However, the following sentence pair does not entail each other.
  - John went to school.
  - John attended a class.

Entailment II

- Which sentence pairs are in the entailment relationship?
  - Chelsea had a baby boy.
  - Chelsea got married.

  - There are 10 students in the class.
  - There are 5 students in the class.

  - That animal is a dog.
  - That animal is a mammal.

  - The class lasted at least for one and half an hour.
  - The class lasted at least one hour.

Entailment III

- Which sentence pairs are in the entailment relationship?
  - They ambled around the square.
  - They strolled round the square.

  - I left the apartment five minutes ago.
  - I departed from the apartment five minutes ago.

- If the sentences entail each other, we call those sentences are in the **mutual entailment** relationship or **equivalent sentences**.

Entailment IV

- Is there any entailment between the following pairs of sentences (or mutually entailed)?
  - The anarchist assassinated the emperor.
  - The emperor died.

  - I bought a dog today.
  - I bought an animal today.

  - The Etruscans built this tomb.
  - This tomb was built by Etruscans.

  - Alice owns this book.
  - This book belongs to Alice.

Lexical decomposition I

- The meaning of a word can be decomposed into smaller semantic units (also see the hypernym and hyponym relationships above)
  - bachelor = [+ADULT, +MALE, +UNMARRIED]
  - stallion = [+HORSE, +MALE]
  - mare = [+HORSE, +FEMALE]
  - rooster = [+CHICKEN, +MALE]
  - hen = [+CHICKEN, +FEMALE]

	table	*horse*	*boy*	*man*	*girl*	*woman*
ANIMATE	-	+	+	+	+	+
HUMAN	-	-	+	+	+	+
FEMALE	-	-	-	-	+	+
ADULT	-	+	-	+	-	+

- What is [+ANIMATE, + HUMAN]?

Lexical decomposition II

- We can propose the lexical decomposition for the verb too.
  - kill = [CAUSE someone to DIE]
  - give = [CAUSE someone to HAVE something]
  - open = [CAUSE something to BECOME open]
  - break = [CAUSE something to BECOME broken]
  - hit = [HIT something]
  - beat = [HIT something repeatedly/violently]

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