L98: Introduction to Computational Semantics

Lecture 7: Modifiers

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Lecture 7: Modifiers
1. Syntactic behaviour of modifiers
2. The Predicate Modifier (PO) rule
3. Lexical semantics of adjectives

Truth of these statements in our world model?

Remember the world where Trump gave Johnson a golden lighter? Are the following statements true in that world?

1. Johnson gave Trump a lighter
2. Trump gave Johnson a silver lighter
3. Johnson was given a lighter

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$\text{THEME}(e, x) \land \text{lighter'}(x)))$
$\rightarrow$ TRUTH VALUE is 0

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2. Trump gave Johnson a silver lighter

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3. Johnson was given a lighter
$$\exists x((\text{give'}(e) \land \text{RECIPIENT}(e, \text{johnson'}) \land$$
$$\text{THEME}(e, x) \land \text{lighter'}(x)))$$

$$\rightarrow \text{TRUTH VALUE is } 1$$

Review of Modifiers' Syntax

Syntactic behaviour of modifiers

(Note that this section is a reminder of information from L95.)

- Modifiers are adjuncts. They are not subcategorised.
- Arguments reduce the valency of the head they combine with; modifiers leave it unchanged.

There are four main types of modifiers

- adjectives
- adverbs
- prepositional phrases
- relative clauses

Def valency: number or arguments that a subcategorising element (verb, noun) takes. Similar expression: "sleep" is a 1-valued verb, "kiss" is a 2-valued verb, "part" is a 1-valued noun.

Adjectives

- Adjectives modify nouns...
- in the following way

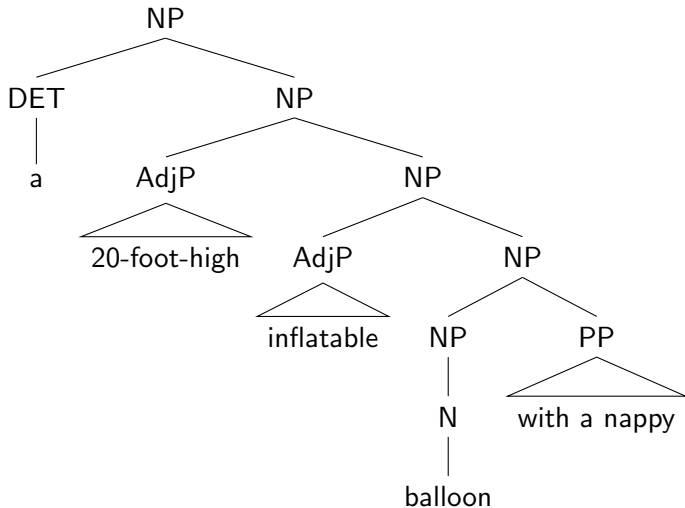(1) a. her voice is hoarse   predicative
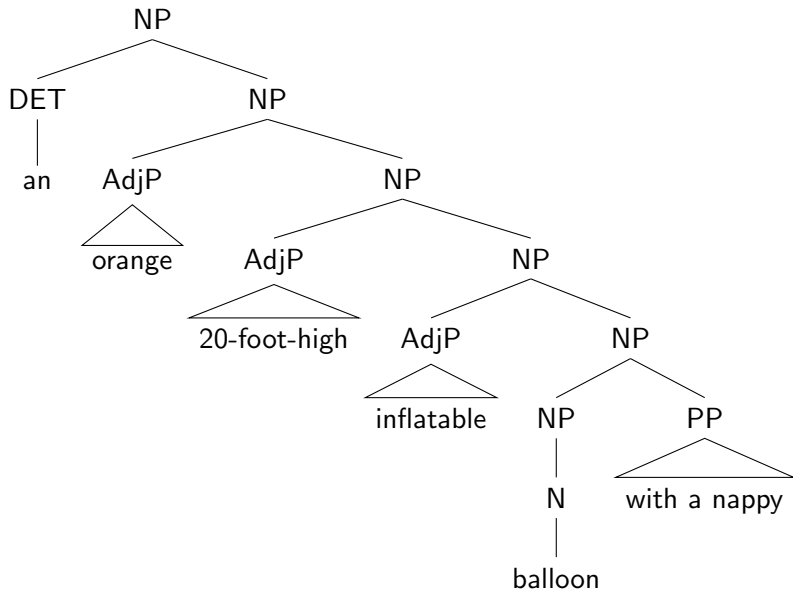
    b. a hoarse voice   attributive

    c. she laughed herself hoarse   resultative

Inflatable Trump

Oops, forgot "orange"

Intersective Interpretation of attributive construction

- What about the semantics?
- Later in this lecture, we will derive the semantics of such constructions using the PM (predicate modification) rule
- You have already seen an example of the desired interpretation in Lecture 6 when we (informally) treated "golden lighter".
- Note that this assumes that "orange" and "golden" are intersective adjectives (or at least used intersectively here)

Adverbs

(2) a. he laughed crazily

    b. this is a crazily expensive kitchen

    c. she ate extremely noisily

    d. obviously, this will not work

Adverb≠Ad+verb

- Adverbs modify

  verbs (mostly describing the manner of the event expressed as in (2a)),

  adjectives or other adverbs (mostly magnitude effect; (2b) vs (2c), respectively)

- They also modify clauses or sentences as in (2d); in these cases they are called sentential adverbs

Usage notes: "likely" as a sentential adverb

(3) This is a likely/probable situation.

(4) This situation is likely/probable.

(5) Probably/*Likely this won't happen.

(6) a. This probably/*likely won't happen. (pre ca. 2010)

    b. This probably/likely won't happen. (post ca. 2010)

Prepositional phrases (inside NP)

(7) a. a part of Europe

    b. a city in Texas

    c. Susan, from Nebraska,

- PPs can occur inside NP in three roles:
  - as arguments (7a)
  - as restrictive modifiers (7b)
  - as non-restrictive modifiers (7c)
- We will only treat restrictive PP modification here.
- We have already treated arguments in Lecture 5/6.
- Non-restrictive modifiers effectively constitute conjunctive clauses; not treated here any further.

Prepositional phrases (inside NP)

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Question: is the PP *with nappy* in the following NP restrictive?

(10) a 20-foot-high inflatable balloon with a nappy

PP adjuncts modifying verb phrases

PP adjuncts modify VPs (11a) and sentences (11b):

(11) a. Kim looked into the box with a lot of hope
     b. Despite my warning Kim looked into the box

Is (11b) really a PP modifying a clause? Let's make really really sure...

(12) In 5 minutes, either you will be ready or you will see me leave

Adverbial constructions with similar structure (VP in (a), clause in (b)):

(13) a. Kim looked hopefully into the box
     b. Hopefully, Kim looked into the box

PP-attachment ambiguity

And then of course there is the kind of confusion that occurs between (14), which is the PP-inside-NP reading from two slides before, and (11a):

(14) Kim looked into the box with a lot of eggs
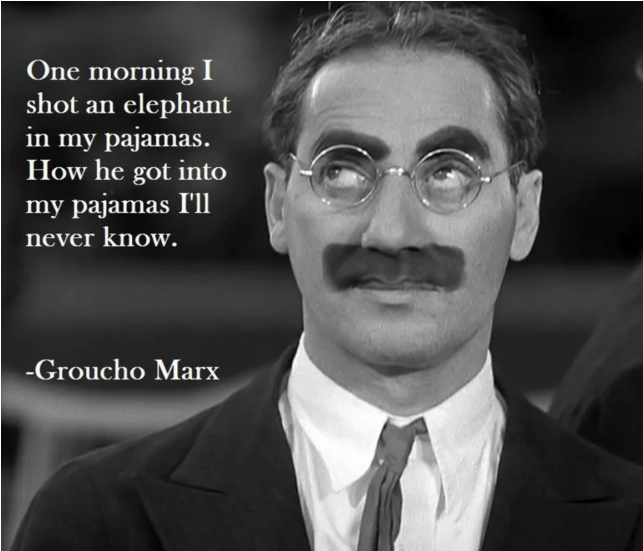
This is the well-known PP attachment ambiguity:

(15) a. I ate the pizza with chopsticks

    b. I ate the pizza with onions

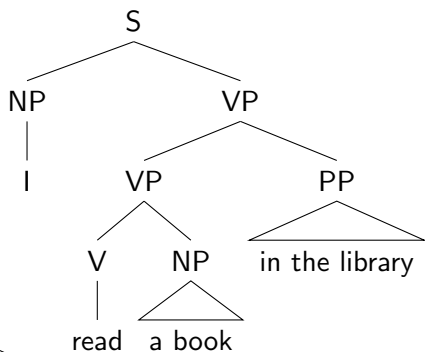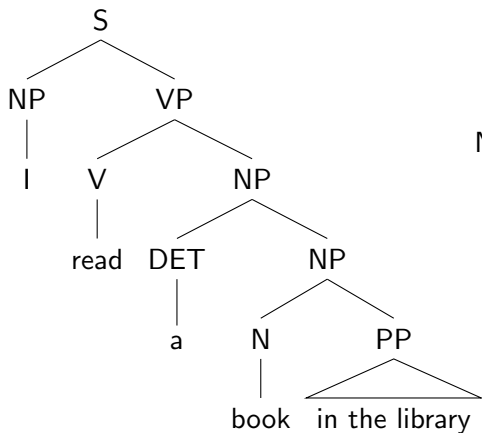(16) a. I saw the man with a hat

    b. I saw the man with a telescope

One morning I shot an elephant in my pajamas. How he got into my pajamas I'll never know.

-Groucho Marx

Sometimes the ambiguity does not matter

(17) I read a book in the library

- The interpretations are (effectively) the same
- Binary branching forces us to commit to one analysis

Relative clauses

Two kinds:

- Restrictive RC: intersective interpretation of both "restricting pieces of information"

- Non-restrictive RC: interpretation as additional information about modified NP

Restrictive vs non-restrictive RC

(18) a. All runners who wore red shirts reached the goal.

b. All runners, who wore red shirts, reached the goal.

- (18a) is a RRC; intersective interpretation
- (18b) is a NRRC; "additional information" interpretation
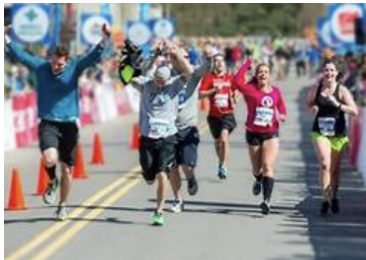
Which of the sentences is the photo of this world compatible with?

How do we know whether I want a NRRC or an RRC?

NP **who/which/that** (RC predicate$_1$) (VP predicate$_2$)
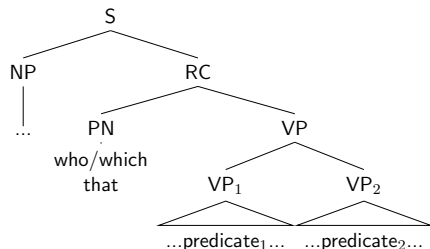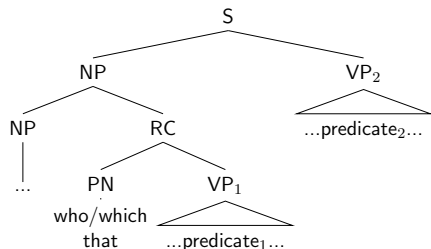
- Are there cases when predicate$_1$ holds and predicate$_2$ doesn't, but you only want to talk about the intersection?
- For instance, when there are red-shirters who fail to reach the goal.
- That's when you **have** to use a RRC (no comma)
- Otherwise you are making a **false** statement

Reduced RC

Active construction:

(19) a. the girl skipping down the road wore a red dress

    b. the girl who was skipping down the road wore a red dress

    c. the girl, who was skipping down the road, wore a red dress

Passive construction:

(20) a. the horse raced past the barn fell

    b. the horse which was raced past the barn fell

    c. the horse, which was raced past the barn, fell

(a) versions of sentences are reduced relative clauses

Reduced relative clauses of this kind are interpreted as restrictive:

- same truth conditions for (a) and (b) versions of these sentences
- different truth conditions for (a) and (c) versions

Object vs subject relative clause

(21) a. The man who kicked the gangster kissed my uncle

     b. The man who the gangster kicked kissed my uncle

     c. The man kissed my uncle who kicked the gangster

     d. The man kissed my uncle who the gangster kicked

$2^2 = 4$ combinations object/subject are possible.

The Predicate Modification Rule

Predicate modification
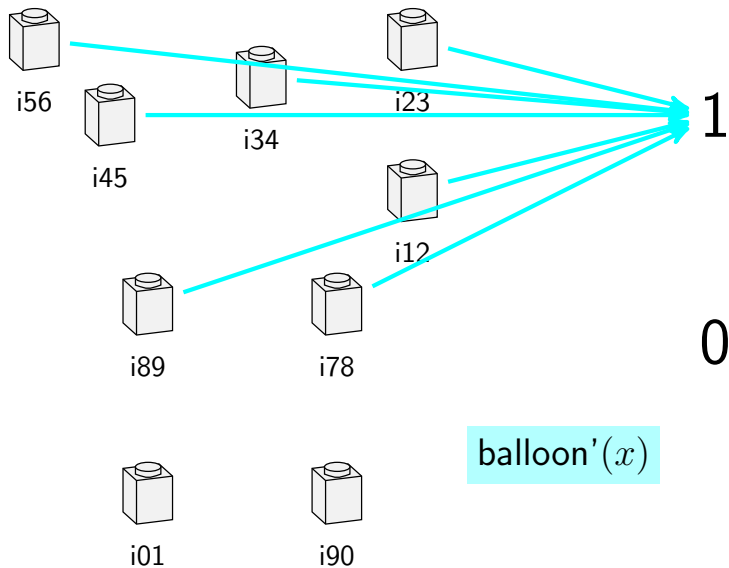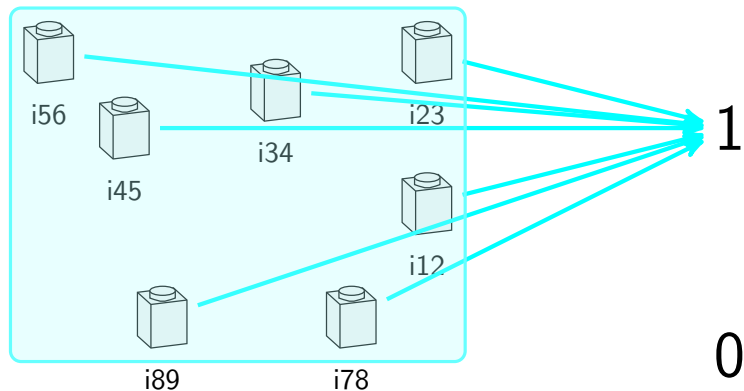

i56

i45

i34

i23

i12
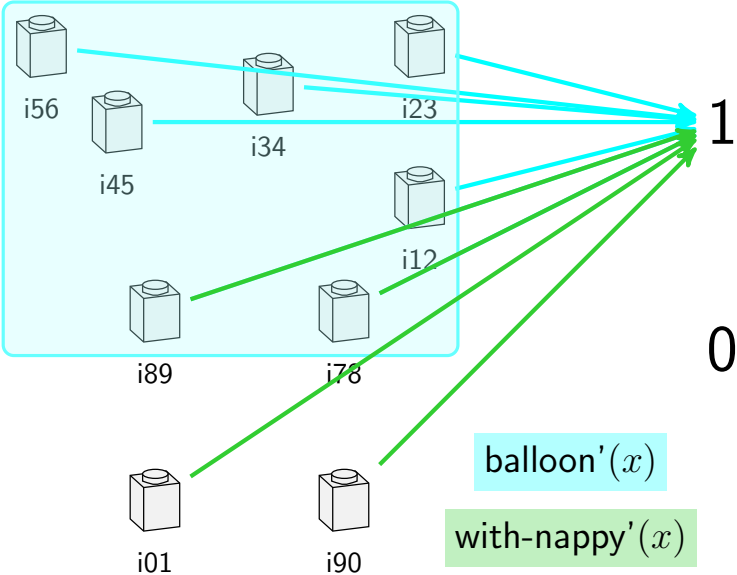
i89

i78
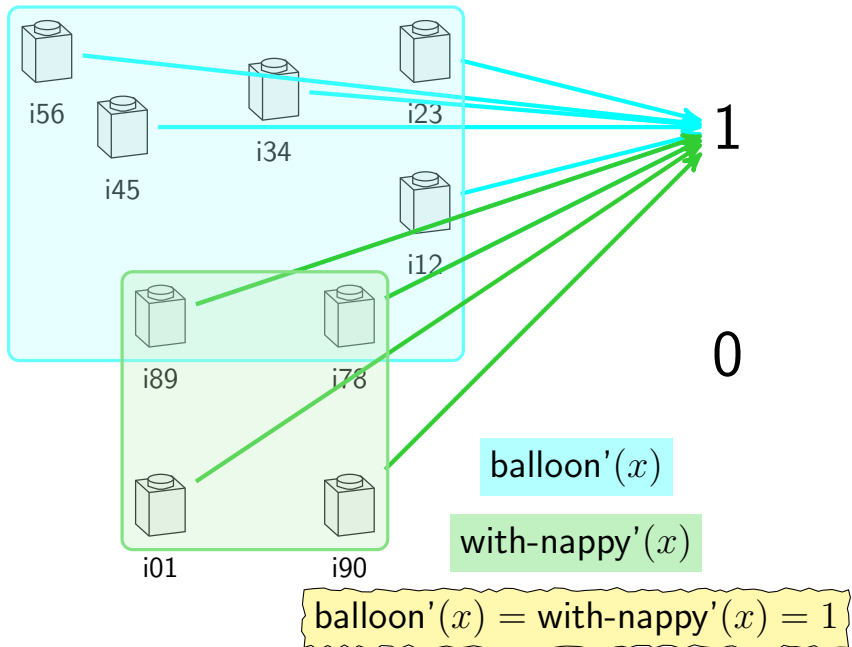
i01

i90

1

0

Predicate modification

Predicate modification

Predicate modification

balloon'(x)

with-nappy'(x)

Predicate modification

balloon'(x)

with-nappy'(x)
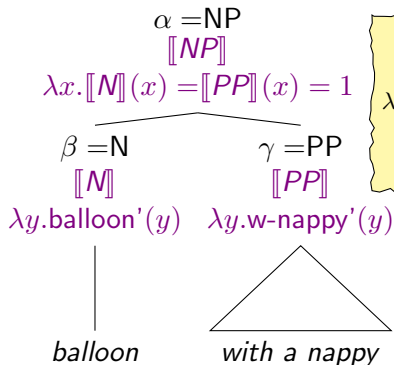
balloon'(x) = with-nappy'(x) = 1

A new composition rule

Predicate Modification (PM)

If α is a branching node, $\{\beta, \gamma\}$ is the set of α's daughters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in $D_{\langle e,t \rangle}$, then

$$[\![\alpha]\!] = \lambda x \in D_{\langle e,t \rangle}.[\![\beta]\!](x) = [\![\gamma]\!](x) = 1$$

$$\lambda x.[\![N]\!](x) = [\![PP]\!](x) = 1$$
$$\Downarrow$$
$$\lambda x.[\lambda y.\text{balloon'}(y)](x) = [\lambda z.\text{w-nappy'}(z)](x) = 1$$
$$\Downarrow$$
$$\lambda x.\text{balloon'}(x) = \text{w-nappy'}(x) = 1$$

Lexical Semantics of Adjectives

Intersective and non-intersective Adjectives

Remember from Lecture 3: modifiers *select* their modifees (head–modifier construction).

Remember from Lecture 4: adjectives have different behaviour when it comes to semantic compositionality:

- Intersective (*green car*, *green frog*)
- Relative intersective (*red hair*)
- Non-intersective (*a suspected murderer*)
- Anti-intersective (*a fake Picasso*)

Cruse (1986): Lexical Semantics, Cambridge University Press

Intersective

- The "green" in "green car" and "green frog" means exactly the same thing.
- Interpretation is well-treated by PM rule above, in a straight-forward set theoretic way, as seen before:
  - $\lambda x.\text{car'}(x) = \text{green'}(x) = 1$
  - $\lambda x.\text{frog'}(x) = \text{green'}(x) = 1$

- *green*: $\langle \mathbf{e}, \mathbf{t} \rangle$
- *frog*: $\langle \mathbf{e}, \mathbf{t} \rangle$
- *green frog*: $\langle \mathbf{e}, \mathbf{t} \rangle$
- *car*: $\langle \mathbf{e}, \mathbf{t} \rangle$
- *green car*: $\langle \mathbf{e}, \mathbf{t} \rangle$

Relative Intersective

Would you call these "red cars"?

Relative Intersective

Would you call these "red cars"?

- "Red" in "red hair" and "red car" might not correspond to the same wavelengths.
- We relativize our requirements according to what the noun is.

Relativization

(22) a. Julius is a grey cat.

   b. Julius is a grey animal.
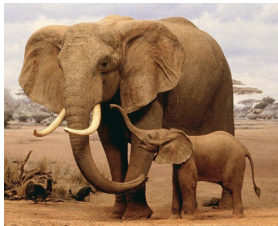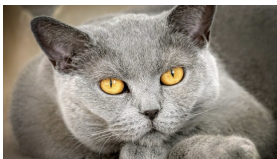
   c. Julius is grey and Julius is a cat.

(23) a. Jumbo is a small elephant.

   b. Jumbo is a small animal.

   c. Jumbo is a small and Jumbo is an elefant.

- (22a) entails both (22c) and (22b) because "grey" is intersective (here)
- (23a) does not entail (23b)
- But does (23a) entail (23c)? Arguably not, as demonstrated by lack of entailment between (23a) and (23b).

Heim and Kratzer's suggestion

"relativisation" of adjectives in the context of the nouns they modify:

$[\![small]\!] = \lambda f.[\lambda x.[f(x) = 1$ *and size*$(x) <$ *avg size of elements of* $\{y : f(y) = 1\}]$

and later (after comparing Jumbo to even larger monsters in a hypothetical context) they go even further:

$[\![small]\!] = \lambda x.[x$'s *size is below* c, *where* c *is the size standard made salient by the utterance context]*

(more on this in discourse lecture 14)

Non-intersective adjectives

(24) a. alleged murderer

       b. suspected fraud

       c. former president

       d. my then girlfriend

       e. let me introduce to you. . . the next president of the United States

Non-intersective adjectives

Think for a moment about the extension of the noun *murderer*; it's a bucket and we want to map it onto a discourse referent, so that we can get a truth-value.

(25) Susan is a murderer

(26) Susan is an alleged murderer

When the *alleged* comes along, it modifies the extension, which is unusual:

- "I don't actually know if or claim that she's a murderer. Only somebody else said so."

- "OK, right now he's not the president – only, we would really hope for him to become it sometime soon."

How to model this semantically? Well, not with an extensional semantics. . .

Anti-Intersective

- A special case of non-intersective.
- Also modifying the extension of the noun; special in that they **negate** the assignment.
- *a fake Picasso*, *non-existent treaty*, *so-called judges*.
- Quotes are doing this too
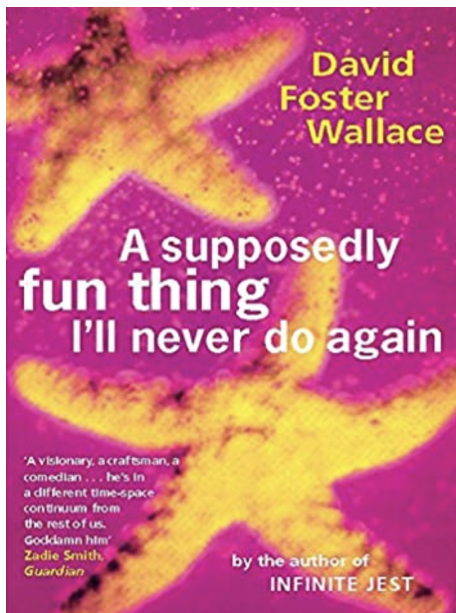
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> It's not really a grammar, right?
> (Why not call it something else then?)

David Foster Wallace

John Lewis
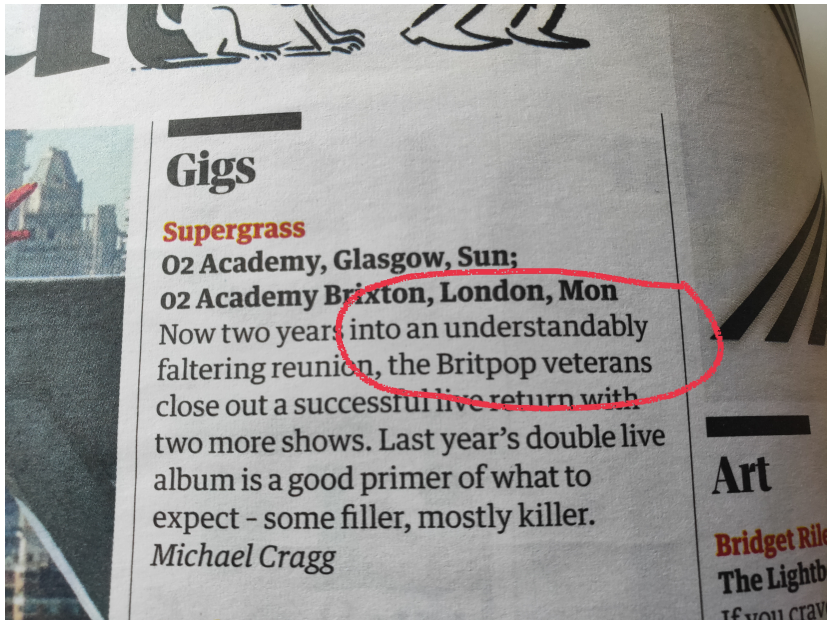
Clearly understandably

Radiohead song: Fake Plastic Trees

(27) a. fake plastic trees

  b. fake rubber plant

Antonyms

- There are different kinds of opposites in adjectives: complementaries and antonyms
- Complementaries express binary states or properties, such as *married* vs *single*
- Antonyms express graded properties, such as *safe* and *unsafe*.
- If two adjectives relate to the same property (e.g., *enthusiastic* and *listless*) but have different semantic orientations they are typically antonyms.
- Few exceptions. *terse* and *verbose* have the same semantic orientation.

Three types of antonyms

- **overlapping** antonym
  - evaluative, carry semantic orientation
  - *good–bad*
- **equipollent** antonym
  - often correlated with sensory perceptions
  - *hot–cold*
- **polar** antonym
  - neutral/descriptive
  - highest level of abstraction
  - *long–short*

Antonym Test 1: Pseudo-comparatives and true comparatives

(28) a. This box is light, but it's heavier than that one.

    b. ?Today it's cold, but hotter than yesterday.

Heavy seems to express a relative property (greater weight). This is the sign of a polar antonym.

Hot seems to express an absolute property; sign of an equipollent antonym.

- *hotter* is a true comparative of *hot*
- *heavier* is
    - a pseudo-comparative of *heavy/1*, and
    - a true comparative of *heavy/2*

Antonym Tests: How-adj questions possible for both? Impartial?

Only one possible for *long–short* (polar):

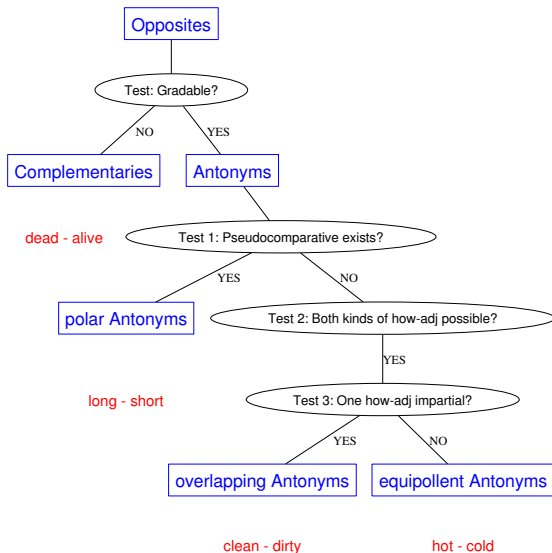(29) a. How long is it? → impartial

   b. ?How short is it?

Both committed for *hot–cold* (equipollent):

(30) a. *How cold is it?* → committed

   b. *How hot is it?* → committed

Only one committed for *clean–dirty* (overlapping):

(31) a. *How clean was the room?* → impartial

   b. *How dirty was the room?* → committed

Oppositeness and Antonymy

Linguistic polarity vs natural polarity

- Can we predict which one of the antonyms is more "salient"?
- **Test A**: The antonym that can be paraphrased as the other one plus a negative prefix is the less salient one.
- **Test B**: The more salient antonym yields the impartial interpretation in the how-adj question.
- **Test C**: The more salient antonym is associated with "more" properties:
  - *Something is dead when there is no life present.*
  - *? Something is alive when there is no deadness present.*
- Prediction/observation: the more salient antonym often has a positive polarity

Adjective Ordering: received wisdom

1	2	3	4	5	6	7	8
General opinion	Specific opinion	Size	Shape	Age	Colour	Nationality	Material

learnenglish.britishcouncil.org

Another piece of advice about adjective ordering

Determiner	Quantity or number	Quality or opinion	Size	Age	Shape	Color	Proper adjective	Purpose or qualifier	Noun
A		beautiful		old			Italian	sports	car
The	three	beautiful	little			gold			plates
An		amazing			heart-shaped	red and white			sofa

gingersoftware.com

Adjective Ordering: humans

- You tried with boxes in your prelecture exercise.
- Maybe this is different with human descriptions?
- The object is waiter, and the waiter is:
  - dark-haired
  - French
  - 39 years old
  - good-looking
  - overweight
  - small
  - dangerous
  - humourless
- How do you order them now?

Adjective Ordering: computational approaches

- Shaw and Hatzivassiloglou (1999): Ordering among premodifiers. ACL
- Malouf (2000): The order of prenominal adjectives in natural language generation. ACL.
- Lapata and Keller (2004): The web as a baseline. HLT.

Example from Shaw and Hatzivassiloglou (1999)

(a) "John is a diabetic male white 74-
year-old hypertensive patient
with a red swollen mass in the
left groin."

(b) "John is a 74-year-old
hypertensive diabetic white male
patient with a swollen red mass
in the left groin."

Fake rubber plants and adjective ordering

(32) a. a fake Chinese rubber plant
      b. a Chinese fake rubber plant
      c. a Chinese rubber fake plant

(Post-lecture exercise: what does these three NPs mean?)