Compositional Semantics

- Syntax-driven approach to semantic interpretation.
- Assumes a close link between syntax and semantics.
- Instead of S → NP loves NP
  - S[sem=loves(x,y)] → NP[sem=x] loves NP[sem=y]
- Can annotate general rules like S → NP VP:
  - V[sem=loves] → loves
  - VP[sem=v(obj)] → V[sem=v] NP[sem=obj]
  - S[sem=vp(subj)] → NP[sem=subj] VP[sem=vp]
- Now George loves Laura has sem=loves(Laura)(George)
- Logical form of sentences can then be derived bottom-up while parsing, using lambda calculus

Nouns and Their Modifiers

- expert
  - λg expert(g)
- big fat expert
  - λg big(g) & fat(g) & expert(g)
  - But: bogus expert
    - Wrong: λg bogus(g) & expert(g)
    - Right: λg (bogus(expert))(g) ... bogus maps to new concept
- {every/three} goldfish that Gilly swallowed
  - λg [goldfish(g), swallowed(Gilly, g)]
  - Or for real: λg [goldfish(g), ∃e [past(e), act(e,swallowing), swallower(e,Gilly), swallowee(e,g)]]
  - like three swallowed-by-Gilly goldfish

Quantifier Order

- Gilly swallowed a goldfish in a booth
  - ∃e past(e), act(e,swallowing), swallower(e,Gilly), exists(goldfish, swallowee(e)), exists(booth, location(e)), ...
- Gilly swallowed a goldfish in every booth
  - ∃e past(e), act(e,swallowing), swallower(e,Gilly), exists(goldfish, swallowee(e)), all(booth, location(e)), ...

  ∃g goldfish(g), swallowee(e,g) ∀b booth(b)⇒location(e,b)

- Does this mean what we'd expect??

  says that there's only one event
  with a single goldfish getting swallowed
  that took place in a lot of booths ...

Quantifier Order

- Groucho Marx celebrates quantifier order ambiguity:
  - **In this country a woman gives birth every 15 min. Our job is to find that woman and stop her.**
  - ∃woman (∀15min gives-birth-during(woman, 15min))
  - ∀15min (∃woman gives-birth-during(15min, woman))
  - Surprisingly, both are possible in natural language!
  - Which is the joke meaning? (where it's always the same woman)

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- Gilly swallowed a goldfish in every booth
  - ∃e past(e), act(e,swallowing), swallower(e,Gilly), exists(goldfish, swallowee(e)), all(booth, location(e)), ...

  ∃g goldfish(g), swallowee(e,g) ∀b booth(b)⇒location(e,b)

- Does this mean what we'd expect??
  - It's ∃e ∀b which means same event for every booth
  - Probably false unless Gilly can be in every booth during her swallowing of a single goldfish

Quantifier Order

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- Gilly swallowed a goldfish in every booth
  - ∃e past(e), act(e,swallowing), swallower(e,Gilly), exists(goldfish, swallowee(e)), all(booth, λb location(e,b))
- Other reading (∀b ∃e) involves quantifier raising:
  - all(booth, λb [∃e past(e), act(e,swallowing), swallower(e,Gilly), exists(goldfish, swallowee(e)), location(e,b)])
  - "for all booths b, there was such an event in b"