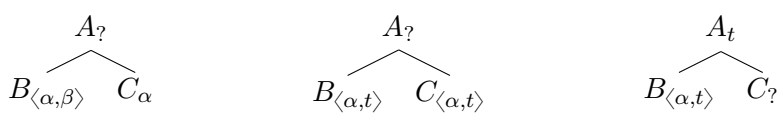
Review of Compositional Semantics

1 Review of Compositional Semantics

- Preliminary notions and concepts:
  - Truth conditions
    The sentence "_____" is true if and only if _____.
  - Extension (of a sentence, 1-place predicate, 2-place predicate, ...)
    $[\![X]\!]^w$ ('the extension of X in w')
  - The principle of compositionality
- Type theory
  - Types
    - Basic types: e for entities, t for truth values
    - Functional types: If α and β are types, then $\langle \alpha, \beta \rangle$ is a type.
  - Determine types of nodes in a tree:



Syntactic category	Label	**English expressions**	**Semantic type** (extensionalized)
Sentence	S		t
Proper name	ProperN	*John*	e
e-type/referential NP	DP	*the king*	e
Common noun	CN	*cat*	$\langle e, t \rangle$
IV, VP	V_{itr}, VP	*run*, *love Kitty*	$\langle e, t \rangle$
TV	V_{tr}	*love*, *buy*	$\langle e, et \rangle$
Predicative ADJ	Adj	*happy*, *gray*	$\langle e, t \rangle$
Predicate modifier	Adj, Adv	*skillful*, *quickly*	$\langle et, et \rangle$
Sentential modifier		*perhaps*, *not that*	$\langle t, t \rangle$
Generalized quantifier	DP	*someone*, *every cat*	$\langle et, t \rangle$
Quantificational determiner	D	*some*, *every*, *no*, *a*	$\langle et, \langle et, t \rangle \rangle$
Definite determiner	D	*the*	$\langle et, e \rangle$
Relative clause	REL	*who invited Andy*	$\langle e, t \rangle$
		a	$\langle et, et \rangle$, or $\langle et, \langle et, t \rangle \rangle$
		is	$\langle et, et \rangle$, or $\langle e, et \rangle$
		that	$\langle t, t \rangle$, or $\langle et, e \rangle$

- Lambda calculus
  - Schema of lambda terms:
    $\lambda v[\beta.\alpha]$ read as "the function which maps every v such that β to α"
  - Lambda reduction/conversion
    $(\lambda v.\alpha)(x) = \alpha'$ where α' is like α but with every *free* occurrence of v replaced by x.
  - Semantic types of lambda terms
    If v is of type σ and α is of type τ, then $\lambda v.\alpha$ is of type $\langle\sigma, \tau\rangle$.
  - Defining semantics of natural languages expressions using λ-notations
    * Predicates: *run*, *hit*, *cat*, *gray*, *larger than*, *from*
    * Other functions: *not*, *and*, *fast*
    * Vacuous words: *is*, *a*, *that*
      (Note that these words are usually semantically ambiguous)
- Semantic composition
  - Syntactic rules and Tree diagrams
    (Requirement: with provided phrase structure rules, draw a tree diagram for a sentence)
    * Phrase structure rules
      · Branching rules: A → B C
      · Non-branching rules: A → B
    * Vocabulary
  - Composition rules:
    * Basic rules: Terminal Nodes, Non-branching Nodes, Functional Application,
    * Other rules: Predicate Modification, Predicate Abstraction
  - Type mismatch
- Determiners and generalized quantifiers
  - Definite determiner: *the*
    * Uniqueness requirement of *the*
  - Quantificational determiner: *some*, *every*, *no*
    * Restrictor and scope of a quantificational determiner
  - Generalized quantifier: *someone*, *every cat*
    * Why is it that generalized quantifiers are not entities?
- Quantifier raising, movement, scope ambiguity
  - What motivates quantifier raising?
  - Quantifier raising is a covert movement taking place at the logical form.
  - How do you represent movement in compositional semantics?

2 Explaining the interesting facts!

- In the first week of this class, we saw a number of interesting semantic phenomena. Now let's see how the concepts and technicalities learned in this class explain those phenomena.

- **Fact 1**: Sometimes, an inferences implied by a positive sentence is also implied by the corresponding negative sentence:

  (1) a. Andy's cooking is always bad.
  b. Andy's cooking is not always bad.
  Both ab imply: *Andy's cooking is (at least) sometimes bad.*

  (2) a. Suzi knows that Andy's cooking is bad.
  b. Suzi doesn't know that Andy's cooking is bad.
  Both ab imply: *Andy's cooking is bad.*

  Your explanation:

- **Fact 2**: Sometimes, the same sentence has multiple readings (*scope ambiguity of quantifiers*):

  (3) Every shark attacked a pirate.

  √ Every shark attacked a (different) pirate.

  √ Every shark attacked the same pirate.

  Your explanation:

- **Fact 3**: Sometimes, a negative is not interpreted at where it is stated (*neg-raising*):

  (4) John does**n't** believe that Mary won the race.
  = *John believes that Mary did***n't** *win the race.*

  Explanations:

– *Presupposition-based analysis* (Bartsch 1973, Gajewski 2007):

  believe triggers a presupposition that the agent is opinionated about the truth/falsehood of the embedded clause. The assertion and this presupposition together entail the NR reading.

  (5) John doesn't believe p.

not [John believes p]	Assertion
John believes p, or John believes $\neg p$	Opinionated presupposition
$\therefore$ *John believes not-p.*	NR reading

– *Implicature-based analysis* (Romoli 2014, Xiang 2014):

  The unopinionated condition *John isn't opinionated at p* is a stronger alternative of (**??**). Affirming the prejacent and denying this stronger alternative yield an NR reading.

  (6) John doesn't believe p.
  a. O [$_S$ not [John believes p]]
  b. ALT(S) = {$\neg$ [John believes p], $\neg$ [John believe p or John believes $\neg p$}
  c. $\neg$ [John believes p] $\wedge \neg\neg$ [John believe p or John believes $\neg p$]
  = $\neg$ [John believes p] $\wedge$ [John believe p or John believes $\neg p$]
  = John believes $\neg p$

- **Fact 4**: Semantics interacts prosody.

  (7) a. We only asked ANDY to hand in homework one.
  → *We didn't ask Billy to hand in homework one.*
  b. We only asked Andy to hand in homework ONE.
  → *We didn't ask Andy to hand in homework two.*

  Explanation (Rooth 1985, 1992, 1996):

  The stressed item is focused and is associated with a set of focus-alternatives (just like that a scalar item is associated with a set of scalar alternatives). *Only* presupposes the truth of its prejacent, and negates the focus alternatives that are not entailed by the prejacent.

  (8) a. only [$_S$ we asked ANDY to hand in homework one]
  b. Alt (S) = {we asked x to hand in homework one: $x \in$ {Andy, Billy}}
  c. $\neg$ [we ask Billy to hand in homework one]

  (9) a. only [$_S$ we asked Andy to hand in homework ONE]
  b. Alt (S) = {we asked Andy to hand in homework x: $x \in$ {one, two}}
  c. $\neg$ [we ask Andy to hand in homework two]