The Simplest Compositional Semantics

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Representation

Pat believes Chris is tall.

believe(Pat, tall(Chris))

Representation

Pat believes Chris is tall.

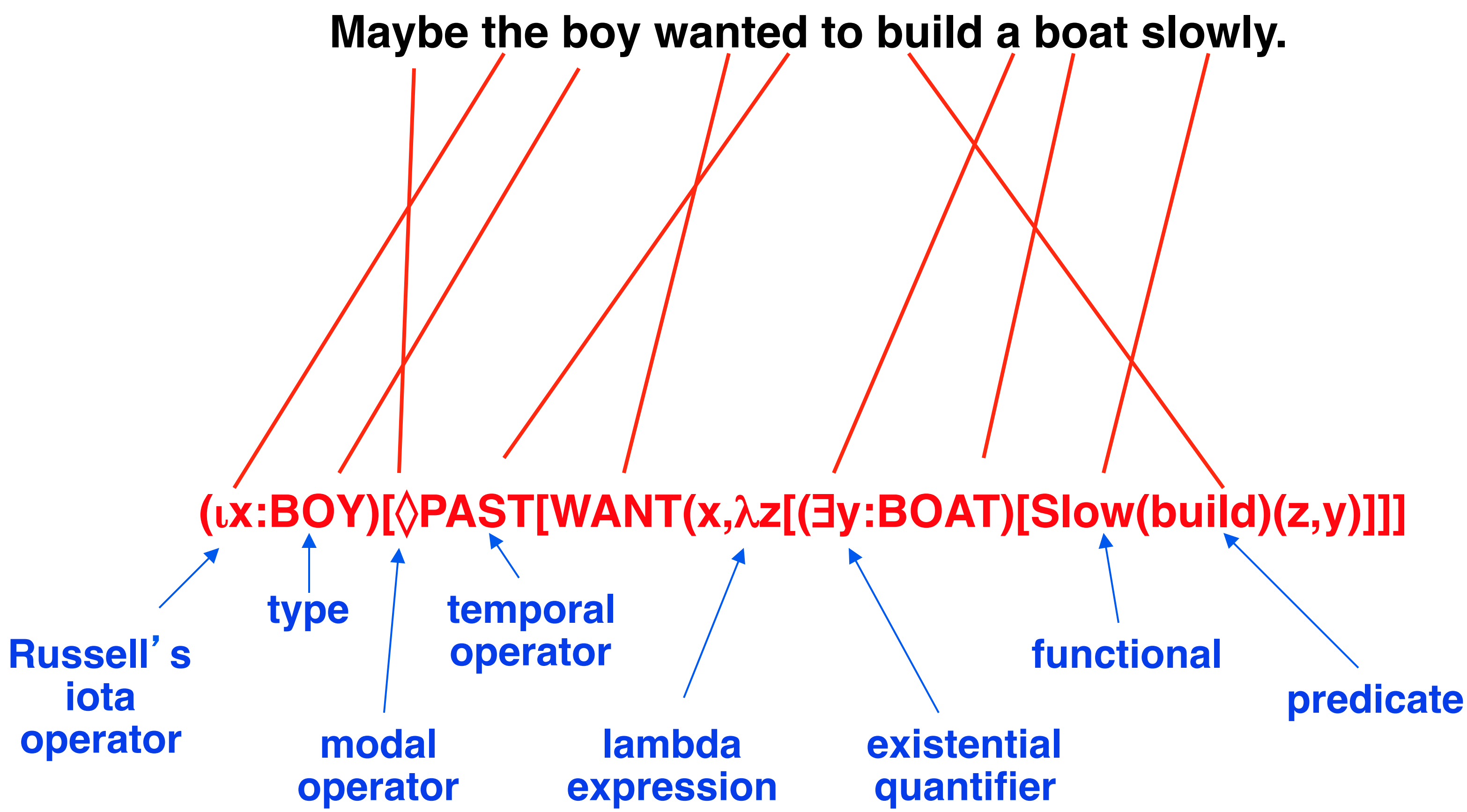
believe(Pat, tall(Chris))

==> believe(Pat, T/F)

Modal Operators

Maybe the boy wanted to build a boat slowly.

Modal Operators



Two Principles of Representation

1. All morphemes are created equal.
2. Every morpheme conveys a predication

Reification

tall(Chris) : Chris is tall.

tall'(e, Chris) : e is the eventuality of Chris's being tall.

believe(Pat, e) & tall'(e, Chris)

Reification

The boy built a boat slowly.

$$boy(x)\ \&\ Past(e)\ \&\ build'(e,x,y)\ \&\ boat(y)\ \&\ slow(e)$$

The eventuality of building the boat

$$(A\ x)[p(x) \longleftrightarrow (E\ e)[p'(e,x)\ \&\ Rexist(e)]]$$

Quantification over a Platonic universe of possible individuals

Asserts the existence of the possible individual in the real world.

Reification

Maybe the boy wanted to build a boat slowly.

maybe(e5) & the(x3,e3) & boy' (e3,x3) & want' (e4,x3,e6) & Past' (e5,e4) & build' (e6,x3,y8) & a(y8,e8) & boat' (e8,y8) & slow(e6)

All first-order logic:
Predicates applied to arguments where the arguments are existentially quantified variables with widest possible scope, ranging over a universe of possible individuals.

Morphemes as Predicates

Maybe the boy wanted to build a boat slowly.

maybe(e5) & the(x3,e3) & boy' (e3,x3) & want' (e4,x3,e6) & Past' (e5,e4)
& build' (e6,x3,y8) & a(y8,e8) & boat' (e8,y8) & slow(e6)

x3 is uniquely mutually identifiable in context
by the speaker and hearer
by virtue of the property e3

==> uniquely-mutually-identifiable-in-context-by-virtue-of-property(x3,e3)

==> the(x3,e3)

Restrictive vs. Nonrestrictive

the tall professor

the(x1,e2&e3) & tall’(e2,x) & professor’(e3,x)

where e2&e3 means e1 s.t. and’(e1,e2,e3)

the philosophical Greeks

the(x1,e2&e3) & philosophical’(e2,x) & Greek’(e3,x) & Plural(x,s)

restrictive

the philosophical Greeks

the(x1,e3) & philosophical’(e2,x) & Greek’(e3,x) & Plural(x,s)

nonrestrictive

Modality

John can not go.

John can go or not go, whichever he wants

John absolutely cannot go.

$\Diamond\neg go(j)$ OR $\neg\Diamond go(j)$

Rexist(e1) & can'(e1,e2) & not'(e2,e3) & go'(e3,j)

vs.

Rexist(e2) & can'(e1,e3) & not'(e2,e1) & go'(e3,j)

Scope of modals recast as predicate-argument relations.

Individuating Eventualities

**Eventuality: State or event under a description.
Therefore individuated very finely.**

run'(e1,P) & fast(e1)

go'(e2,P) & slow(e2)

gen(e1,e2) ← **e1 generates e2: they share the same location and time (stronger than implication)**

Plurals and Quantifier Scope

Sets, type elements of sets, and functional dependencies

professors: professor'(e,x) & Plural(x,s)

Most professors like several textbooks.

most(s1,s) & Plural(x1,s1) & professor'(e,x) & Plural(x,s)
& like'(e3,x1,y) & several(s2) & textbook'(e5,y) & Plural(y,s2)

This is neutral wrt scope.
Inferencing discovers Indiv(y) or FD(y,x)
Advantage: We don't force linear order on quantifiers

Quantifiers are properties of and relations among
entities, sets and descriptions: several, most, the

Underspecification

Lexical ambiguity:

In Logical Form: bank(x)

In KB: (A x) bank1(x) → bank(x)

(A x,y) bank2(x,y) → bank(x)

Pronouns:

Pat gave Kris his computer.

LF: give(p,k,c) & he(x) & Poss(x,c) & computer(c)

Inference discovers x=p or x=k or something else

Syntactic ambiguity:

I see the man with the telescope.

LF: see'(e,I,m,t) & man(m) & with(x,t) & telescope(t) & [x=e | x=m]

Pass on to Inferential Processing the problems that require inference.

But Wait ...

John is tall. ==> john'(e1,x) & tall'(e3,x)

John is not tall. ==> john' (e1,x) & not' (e2,e3) & tall' (e3,x)

P & Q & R --> P & R

So "John is not tall." implies "John is tall."

But Wait ...

Does not say x is tall;
Says e3 is x's being tall.

John is tall. ==> john'(e1,x) & tall'(e3,x)

John is not tall. ==> john'(e1,x) & not'(e2,e3) & tall'(e3,x)

P & Q & R --> P & R

So "John is not tall." implies "John is tall."

Content vs. Claim

Content

Claim

Rexist(e3)

john’ (e1,x) & tall’ (e3,x)

john’ (e1,x) & not’ (e2,e3) & tall’ (e3,x)

Rexist(e2)

Claim

What's True and What Isn't

The lazy man did not manage to avoid attending the meeting.

Step 1: Identify the claim.

not

Step 2: Propagate truth and falsity.

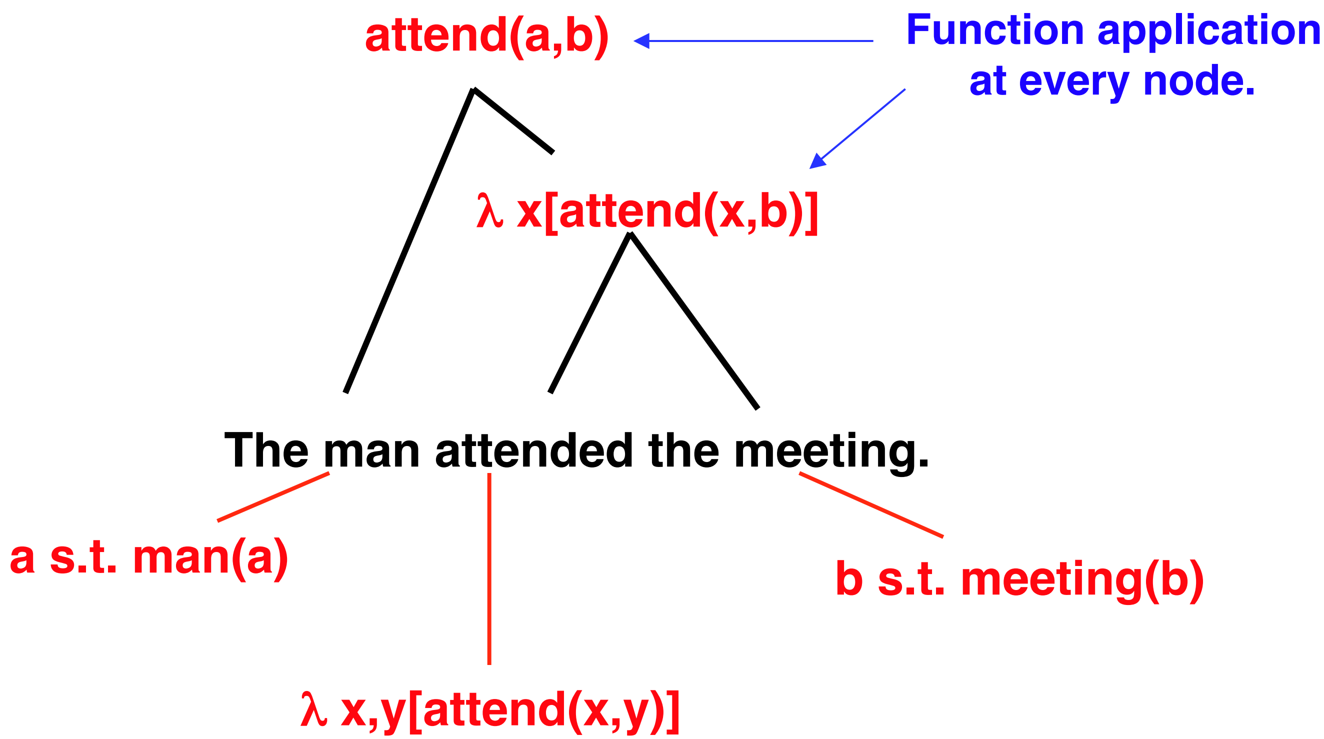
not = T ==> manage = F ==> avoid = F ==> attend =T

Step 3: As a courtesy to the speaker, assume the other propositions are true.

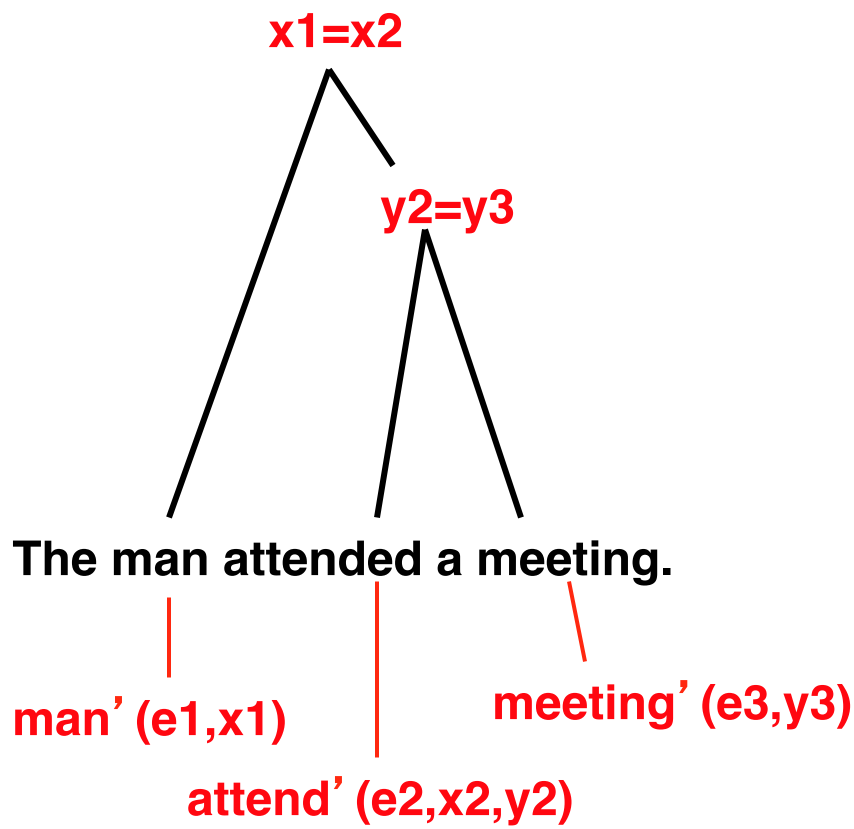
lazy = T; man = T; meeting = T

(But note: in belief contexts, ambiguity between
Rexist: de re
believe: de dicto)

Compositional Semantics: The Standard View



Simple Compositional Semantics



~~Function application at every node.~~

With a flat logical form, the only role of function application is to identify variables.

No lambdas!

(ignoring tense and determiners)

1. The lexicon provides predicate-argument relations.
2. Syntax identifies variables.

Syntax and Compositional Semantics

The only purpose of syntactic analysis is to recover the predicate-argument structure of the text.

Syntax IS natural language's way of encoding predicate-argument structure in strings.

The primary reason to discover predicate-argument structure is to do inference.

What are the Problems?

Morphemes convey predications,
i.e., predicates applied to arguments p(x):

1. What is the predicate? p
   - lexical disambiguation
   - interpreting vague predicates (prepositions,"have", ...)
   - interpreting the implicit relation in nominal compounds
   - vivification, concretization ("go" ==> "fly")

2. What is the argument? x
   - coreference resolution
   - syntactic disambiguation

3. In what way are the predicate and argument congruent? p(x)
   - metonymy
   - metaphor

"Local Pragmatics"

What are the Problems?

Local Pragmatics

Local Coherence:

What information is conveyed by the adjacency of segments of discourse?

Global Coherence:

What role does the discourse play in the participants' plans to achieve things in the world?