LX 321/621 Intro to syntax

Logical Form

#### The Y model

• We're now ready to tackle the most abstract branch of the Y-model, the mapping from SS to LF. Here is where we have "movement that you can't see".



- We think of what we're doing when we construct abstract structures of sentences this way as being a sequence of steps.
  - We start with DS
  - We do some movements
  - We arrive at SS
  - We do some more movements
  - We arrive at LF

• The steps are not necessarily a reflection of what we are doing *online* as we speak—what we are doing is *characterizing our knowledge of language*, and it turns out that we can predict our intuitions about what sentences are good and bad and what different sentences mean by characterizing the relationship between underlying thematic relations, surface form, and interpretation in terms of movements in an order with constraints on what movements are possible.

• It seems that the simplest explanation for the complex facts of grammar is in terms of several small modifications to the DS that each are subject to certain constraints, sometimes even things which seem to indicate that one operation has to occur before another could.



- Concerning SS, under this view, languages pick a point to focus on between DS and LF and pronounce that structure. This is (the basis for) SS.
- There are also certain restrictions on the form SS has (e.g., Case, EPP have to be satisfied).



- We interpret *Bill saw everyone* as
- For every person *x*, Bill saw *x*.
- This is the meaning. This is the *logical form* of the sentence *Bill saw everyone*. In the notation of formal logic, this is written as ∀x. Bill saw x
  'For all x (x a person), Bill saw x.'

- Every boy hates his roommate.
- Notice that each boy hates a different roommate, the roommates are specific to each boy.
- For every boy *x*, *x* hates *x*'s roommate.
- This means that *every boy* doesn't just mean the group of boys; rather it goes through the set of boys and says something about each of them individually.

- These phrases which don't refer to specific people/things in the world but rather seem to do things to sets of people/things are *quantifiers*. Examples include:
  - most students
  - twelve angry men
  - fewer than half of the members
  - some custodian
  - nobody in their right mind

- To write the logical form (meaning) of a sentence with one of these, you put the quantifier first, and replace where it came from with a variable:
- Most students eat at Taco Bell. For most students *x*, *x* eats at Taco Bell
- No administrators eat at Taco Bell. For no administrator *x*, *x* eats at Taco Bell
- Mary likes every flavor of ice cream. For every flavor of ice cream *x*, Mary likes *x*

# Binding

- A quantifier is said to *bind* its variable. That is, the reference of the variable is assigned by the quantifier.
- Bill read every book. For every book *x*, Bill read *x*
- Is this true? Well, let's go through the books. Moby Dick. Did Bill read Moby Dick? Yes. Ok, War and Peace. Did Bill read War and Peace? Yes. Ok, ...

## Scope

- A student read every book.
- When is this true?
  - Mary, it turns out, has read all of the books.
  - Nobody has read everything, but Mary read half of the books and Bill read the other half.
     Every book was read by a student.
- There are two meanings here, the sentence is ambiguous between two logical forms.

## Scope

- A student read every book There is a student *x* such that for every book *y*, *x* read *y* 
  - <u>O</u>r
  - For every book *y*, there is a student *x* such that *x* read *y*
- It matters which quantifier comes first in the logical form.

#### LF

- We think about this in much the same way we think about
  Mary heard a dog bark in the house.
   (either Mary was in the house or the dog was)
- This is a *syntactic* ambiguity, depending on where the PP *in the house* is attached.
- If there are two different interpretations, there are two different *structures*.

#### LF

- LF is the *structure* that we interpret, LF is the *structure* that represents the logical form.
- As syntacticians, we think of this structure in the same way we think of DS and SS—as a tree, with constituents and c-command.

# QR

- Sue read every book. For every book *x*, Sue read *x*.
- Between SS and LF, the quantifier *moves* to a position above the sentence, so there is then a direct mapping between the structure and the logical form.
- [every book]<sub>i</sub> [<sub>TP</sub> Sue read  $t_i$  ].

## QR

- Sue read every book. For every book *x*, Sue read *x*.
- [every book]<sub>i</sub> [ $_{TP}$  Sue read  $t_i$  ].

• Notice that the *trace* is the variable at logical form—moving quantifiers is a way to establish a quantifier-variable structure.

## QR

- Sue read every book. For every book *x*, Sue read *x*.
- [every book]<sub>i</sub> [<sub>TP</sub> Sue read  $t_i$  ].

• This movement is called Quantifier Raising (QR), and it happens to *every* quantifier between SS and LF.

## Quantifiers and binding

- Every girl aced her exams.
- [Every girl]<sub>i</sub> [ $t_i$  aced her<sub>i</sub> exams]
- For every girl x, x aced x's exams
- Not only the trace of QR, but also pronouns, can be bound by the quantifier, their referent determined by the quantifier.

## Quantifiers and binding

- [Every girl]<sub>i</sub> [ $t_i$  aced her<sub>i</sub> exams]
- Binding (assigning reference) is subject to ccommand. A quantifier can only assign reference to a variable (its trace and possibly other pronouns) which it c-commands.
- Her brother said that every girl aced her exams.
- The things which a quantifier c-commands are said to be in its scope.
- Quantifiers can only bind variables in their scope.

## Why believe in QR?

- The thing is: QR is invisible, it is supposed to happen between SS and LF, and since SS is (the basis for) the structure we *hear*, we can't hear its effects—the effect shows up only in the meaning.
- So, is QR just gratuitous formalization? Syntacticians just not knowing when to *stop* already?

- Here's one reason to think that QR is real, that QR is actually *syntactic movement* and not just figments of the imagination of overeager syntacticians: QR *acts* like movement.
- We can detect QR by meanings in sentences with multiple quantifiers—i.e. in *someone likes everyone*.

- A doctor assisted every patient.
- Which patient did a doctor assist *t*?
- A doctor spread the rumor that Bill immunized every patient.
- \*Which patient did a doctor spread the rumor that Bill immunized *t* ?
- A doctor wondered who immunized every patient.
- Which patient did a doctor wonder who immunized *t* ?

- LF: \*[Every patient]<sub>i</sub> [ $_{TP}$  a doctor wondered [ $_{CP}$  who<sub>j</sub> [ $_{TP}$   $t_j$  immunized  $t_i$  ]]]
- LF: \*[Every patient]<sub>i</sub> [<sub>TP</sub> a doctor spread [<sub>DP</sub> the rumor [<sub>CP</sub> that Bill immunized t<sub>i</sub> ]]]
- QR obeys island constraints—like *wh*-movement, it can't get out of a complex noun phrase, it can't get out of a *wh*-island.

- Another reason to believe in QR:
- What did Sue buy?
- Pick the *x* such that Sue bought *x*.
- The interpretation of *wh*-words has the same kind of operator-variable structure that quantifiers do.
- The difference is that *wh*-movement happens where we can see it, but it still leaves a variable behind, bound by the quantifier (*wh*-word).

- There is an interesting property of this kind of operator-variable formation, which we can see in *wh*-movement.
- Who likes his roommate?
- Pick the *x* such that *x* likes *x*'s roommate.
- Who<sub>i</sub> [ $_{TP} t_i$  likes his<sub>i</sub> roommate]
- Like with quantifiers, it is possible to have a pronoun bound by a *wh*-word.

- But now consider this:
- Who does his roommate like?
- Can this mean the same thing as *Whose roommate likes him*?
- \*Who<sub>i</sub> does his<sub>i</sub> roommate like  $t_i$  ?
- How is this different from
- Who<sub>i</sub>  $t_i$  likes his<sub>i</sub> roommate?



- Who<sub>i</sub>  $t_i$  likes his<sub>i</sub> roommate?
- The difference lies in the fact that the *wh*-phrase had to *cross over* the coindexed pronoun on its way to SpecCP. This appears to be impossible, and we can state this as follows:
- Weak Crossover (WCO): A coindexed pronoun cannot intervene between a quantifier and its variable.

- Now, let's look at quantifiers again.
- Every girl likes her roommate.
- For every girl *x*, *x* likes *x*'s roommate.
- Her roommate likes every girl.
- For every girl *x*, *x*'s roommate likes *x*.
- Why can't the second sentence have this meaning?

- [Every girl]<sub>i</sub> [ $_{TP} t_i$  likes her<sub>i</sub> roommate].
- For every girl *x*, *x* likes *x*'s roommate.
- [Every girl]<sub>i</sub> [<sub>TP</sub> her<sub>i</sub> roommate likes  $t_i$ ].
- For every girl *x*, *x*'s roommate likes *x*.
- Answer: WCO again. But WCO is about moving a quantifier over a variable—so if WCO rules out this meaning, there must have been movement. There must have been QR. A movement we couldn't see.

## ACD

- Here's another reason, *antecedent contained deletion*. This one's kind of complicated, so hang on tight.
- First, we need to talk about VP ellipsis.
- Mary bought a record, and Bill did too.
- [<sub>TP</sub> Mary -ed [<sub>VP</sub> buy a record]] and [<sub>TP</sub> Bill -ed [<sub>VP</sub> buy a record]] too.

- Mary bought a record and Bill bought a tape. ≠ Mary bought a record and Bill did too.
- VP ellipsis is allowed *when a preceding VP is identical*.
- To *interpret* this, you need to use the content of the preceding VP.
- Mary bought a record and Bill did (buy a record) too.

- We will consider the process of VP ellipsis to be one of *deletion under identity*.
- DS:

-ed [ $_{VP}$  Mary sleep] and -ed [ $_{VP}$  Bill sleep] too.

• **SS**:

Mary -ed [ $_{VP} t$  sleep] and Bill -ed [ $_{VP} t$  sleep] too

- LF: Mary -ed [ $_{VP} t$  sleep] and Bill -ed [ $_{VP} t$  sleep] too
- just after SS on the way to PF: Mary -ed [<sub>VP</sub> t sleep] and Bill -ed (<sub>VP</sub> Mary slept and Bill did too



- So, as long as two VPs in sequence look identical (where traces of movement look identical to one another—they sound the same), we are allowed to pronounce the second one very quietly.
- Like an extreme case of Mary bought a record and Bill bought a record too.

- Note that *identity* is actually fairly abstract.
- John slept and Mary will too.
- John slept and Mary will sleep too.
- SS: John -ed [<sub>VP</sub> t sleep] and Mary will [<sub>VP</sub> t sleep] too
- Further support for "affix hopping" being "phonological" (after SS, on the way to PF); the V doesn't *inherently* have a tense suffix.

## ACD

- Now, consider a DP with a relative clause:
- the record [which<sub>i</sub> Mary bought  $t_i$  ].
- Bill likes [the record which Mary bought].
- Bill likes the record which Mary bought and Sue does too.
- Bill likes the record which Mary bought and Sue does (like the record which Mary bought) too.

## ACD

- Bill likes every book Mary does.
- Bill [<sub>VP</sub> likes every book  $Op_i$  Mary [<sub>VP</sub> likes  $t_i$  ]].
- VP: likes [every book *Op* Mary likes *t* ]
- VP: likes t
- Those aren't the same. VP ellipsis *shouldn't* work, but yet it does.
- The deleted VP is *contained* in the antecedent VP (*antecedent-contained deletion*)

## QR and ACD

- But now let's consider what QR would do.
- *Every book that Mary does* is a quantifier.
- Quantifiers have to move up past the subject by LF.
- Bill likes every book Mary does.
- SS: Bill [<sub>VP</sub> likes [every book Op<sub>i</sub> Mary [<sub>VP</sub> likes t<sub>i</sub> ]]].
- LF: [every book  $Op_i$  Mary [<sub>VP</sub> likes  $t_i$  ]]<sub>i</sub> Bill [<sub>VP</sub> likes  $t_i$  ].
- But now the VPs are identical.
- So if we believe in QR, we can explain ACD sentences in a natural way.

#### LF

• It looks like there is a *syntactic* structure that is crucial for interpretation—it seems to be derived by *movement*. LF is the syntactic representation from which we get the logical form.

## Where do quantifiers go?

- Every student left.
- [Every student]<sub>i</sub> [<sub>TP</sub>  $t_i$  left ]
- We need a variable in subject position, so QR must be moving the quantifier out of TP, to somewhere higher than TP.
- Believe me that it is also moving somewhere *lower* than CP.

### A new position

- In order to accommodate this, we need to formulate a new position to which quantifiers move.
- This position is going to be *adjoined to TP*.
- This is an extension of the concept of adjunction to X-bar and to X heads, and it looks like this.



#### A new position

- This QP is *not* in SpecTP, it is kind of on the *edge* of TP, hooked on top.
- There is still only one SpecTP.
- In fact there is really only one TP node. QP
- QP is not dominated by TP because it is "partly inside" and "partly outside" of TP (there is a *segment* of TP which doesn't dominate QP, hence TP as a whole doesn't dominate QP).
- QP c-commands the material inside TP, but TP does not c-command QP.



#### The Y model

 So, we now have a case for there being some movement that happens *between* SS (surface form) and LF (interpretation). Covert movement. Hidden from view. But still subject to the rules of syntax and movement.



#### Covert wh-movement

- There is another, somewhat related argument for covert movement of *wh*-phrase as well.
- What did Sue buy?
- Pick the *x* such that Sue bought *x*.
- The interpretation of *wh*-words has the same kind of operator-variable structure that quantifiers do.
- However, the difference is that it looks like this movement happens visibly ("overtly") between DS and SS. Right?

#### Covert wh-movement

- Who bought what?
- Who gave what to whom?
- Pick the *x* and pick the *y* such that *x* bought *y*.
- Pick the *x* and pick the *y* and pick the *z* such that *x* gave *y* to *z*.
- It seems that for *interpretation*, we need to create operator-variable chains for each *wh*-word, yet we only create *one* before SS.

#### Covert wh-movement

- This suggests that there is covert movement of the other *wh*-phrases as well, like QR...
- LF: [ $_{CP}$  Who<sub>i</sub> what<sub>j</sub> [ $_{TP}$   $t_i$  bought  $t_j$  ]]
- LF: someone<sub>i</sub> everyone<sub>j</sub> [ $_{TP} t_i$  met  $t_j$ ]
- LF: everyone<sub>j</sub> someone<sub>i</sub> [ $_{TP} t_i$  met  $t_j$ ]

- English: One *wh*-phrase moves to the front.
  What did Bill give to whom?
- Japanese: No *wh*-words move to the front.
  - Taroo-ga dare-ni nani-o ageta no?
    T-nom who-to what-acc gave Q
    'What did Taroo give to whom?'
- Bulgarian: All *wh*-words move to the front.
  - Kakvo na kogo Ivan dade?
    what to whom Ivan gave
    'What did Ivan give to whom?'

- Yet in all of these languages, the *meaning* of *What did Bill give to whom?* is the same...
- Pick the *x*, pick the *y*, such that Bill gave *x* to *y*.
- The meaning has a quantificational (operatorvariable) structure, so if the meaning (logical form) in all of these languages is derived from LF, these quantifier-variable chains must *be there* at LF.

- In this sense, Bulgarian looks like its SS is quite close to the necessary LF.
- Bulgarian: All *wh*-words move to the front.
  - Kakvo na kogo Ivan dade?
    what to whom Ivan gave
    'What did Ivan give to whom?'
- Pick the *x*, pick the *y*, such that Ivan gave *x* to *y*.
- We *see* the *wh*-phrases moving in Bulgarian. But we know from the meaning that all of these movements have to happen in all languages.

- We conclude then that languages differ *not* in *whether* they move all of the *wh*-words to the front of the sentence—they all do—but rather in *when* they move them there.
- Bulgarian: All between DS and SS.
- Japanese: All between SS and LF.
- English: One between DS and SS, the rest between SS and LF.

- We can phrase this in terms of overt and covert movement:
- Bulgarian: All *wh*-movement is overt.
- Japanese: All *wh*-movement is covert.
- English: One *wh*-phrase moves overtly, the rest move covertly.

- This allows us a fairly uniform view of languages.
- Across languages, DS is basically the same (theta requirements, functional projections).
- Across languages, LF is basically the same (meanings, scope, etc.).
- This means that across languages, the *movements* that happen between DS and LF are basically the same.
- What differs is the *timing*—whether the movements happen before SS or after SS on the way to LF.

• So in terms of *wh*-movement, we can say that the languages pick different parts of the derivation to focus on as SS.



#### Scope and *wh*-movement

- In a *wh*-question, you have a [+Q], [+WH] C and some *wh*-words.
- The *wh*-words have to move up to the [+WH] C. From here they have scope over the rest of the question.
- Where the [+WH] C is determines the scope of the *wh*-phrases.
- What<sub>i</sub> C did John say  $t'_i$  that he wanted to buy  $t_i$ ?
- John knows what<sub>i</sub> C he wanted to buy  $t_i$ .

- Who did Bill persuade to buy what?
  - (Bill persuaded Mary to buy a book, he persuaded Larry to buy a coffee table, he persuaded Sue to buy a futon, ...)
- Pick the *x*, pick the *y*, such that Bill persuaded *x* to buy *y*.
- So both *wh*-words (*who* and *what*) take scope at the matrix clause SpecCP.

- Who did Bill persuade to buy what?
- \*What did Bill persuade who to buy?
- It seems that we can't just choose just any *wh*-word to move to SpecCP—one works, one doesn't. What's the difference between the two?

- Superiority: The shortest *wh*-movements have to happen first. (*Wh*-movement isn't possible if there was a shorter one).
- Who<sub>i</sub> did Bill persuade  $t_i$  to buy what?
- \*What<sub>i</sub> did Bill persuade who to buy  $t_i$ ?

- There is also a strict ordering for languages where all *wh*-words move to the front. We take this to also be due to Superiority:
  - cine ce a vazut
    who whom has seen
    'Who saw whom?'

Romanian

- \*ce cine a vazut
  whom who has seen
  'Whom did who see?'
- The higher *wh*-word has to move first (by Superiority) and shows up first.

# Where have all the *wh*-words gone?

- This brings up an interesting question which we haven't addressed yet—if all of the *wh*-words are moving (in all languages, some overtly like in Bulgarian and Romanian), where are they going?
- English moves its one *wh*-word to SpecCP.
- There is only one SpecCP.
- Are the other *wh*-words not moving to SpecCP?

# Where have all the *wh*-words gone?

• Following an influential proposal by Rudin (1988), many people assume that the other *wh*-phrases move up and *adjoin to the wh-phrase already in the specifier*.



# Where have all the *wh*-words gone?

• This way, there is still *one* specifier of SpecCP, but the *wh*-words are still all in the specifier of SpecCP, one attached to the others. (Things are actually more complicated than this, but this is a good approximation of how one class of languages works—cf. Syntax II!)



- Who knows where we bought what?
  - (Bill does—he knows all about things bought and places those things were bought from).
  - (Bill knows where we bought the coffee table, Mary knows where we bought the futon, ...)
- The second reading presents a problem. Both *who* and *what* take scope at the matrix clause's SpecCP. What's the problem?

- The same as the problem with
- ??What<sub>i</sub> does Bill know where we bought  $t_i$  ?
- Moving what here to the matrix SpecCP violates Subjacency, so the sentence sounds somewhat off. Yet:
- Who knows where we bought what?
- ...sounds fine, even on the "list" reading.

- What's different? Why is the reading with *what* associated with (moved to) the matrix SpecCP allowed in one case and not the other?
- ??What<sub>i</sub> does Bill know where we bought  $t_i$  ?
- Who knows where we bought what?

- These sentences would suggest that covert *wh*-movement is not sensitive to *wh*-islands. A very widely adopted assumption about Subjacency is made to explain this:
- Subjacency only holds for overt movement.
- Because *what* in *Who knows where we bought what?* moves covertly, it is no longer subject to Subjacency and can just move directly into the matrix SpecCP.

- This leaves open some loose ends, and people have not reached their final conclusions on whether Subjacency does or does not hold of covert movement.
  - For one thing, QR seemed to obey Subjacency.
  - On the other hand, it appears that in *wh-in-situ* (no overt *wh*-movement) languages, *wh*-words are allowed in islands.

#### Wh-in-situ languages

- Ni xiang-zhidao [shei mai-le sheme]? you wonder who bought what 'What do you wonder who bought?'
- Mary-wa [John-ni nani-o ageta hito]-ni atta no?
   M-top J-to what-acc gave man-dat met Q
   'What did Mary meet [the man who gave *t* to John]?'
- These are sentences which are possible in Chinese, Japanese, but not in English. They have *wh*-words inside islands.

#### So...

- We've seen some evidence in favor of the existence of LF and movement occurring between SS and LF.
  - QR (moves quantifiers, adjoins to TP)
  - Wh-movement (moves wh-phrases into SpecCP, adjoins wh-phrases after the first one to the first wh-phrase.
  - Subjacency? Doesn't seem to count for covert wh-movement, but did seem to count for QR...

