

## Some English Constructions Transformational Framework

Lecture 7

October 2, 2012

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## Some things are hard with Context-Free Grammars

- Assignment of structures to discontinuous constituents
  - A man wearing earrings walked by
  - A man walked by wearing earrings
- Agreement
  - 3<sup>rd</sup> person singular subjects get an "s" on the end of the verb (even though there may be a gap between the head of the subject and the verb)
- Certain regularities seem to be at the word sequence level (e.g., verbs such as "call up")
- \*\* Assignment of structure to related sentences that may look different. E.g.,
  - John hit the ball – The ball was hit by John
  - Who did John see – John saw Mary

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## Chomsky – generalized rewrite rules

Now a derivation could not be captured in a phrase structure tree – that is just 1 step in a derivation

1. Generate a phrase structure tree down to level of lexical categories
2. Insert lexical items according to lexical rules (this step yields a **DEEP STRUCTURE**)
3. Perform transformations on this tree structure using rules (some obligatory, some optional)
4. Use morphological rules to read off the actual words

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## Why look at this?

- This DEEP STRUCTURE is generally the level that people thought one should run semantics on – all sentences with same deep structure have the same underlying meaning.
- The transformational framework is not really used in NLP – but I find it useful to explain some of the data that we see. You will see other grammatical formalisms try to "recapture" many of the things the transformational grammar explains.

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## Helping Verbs in English

Helping verbs – auxiliary verbs – have, be, and the modals (e.g., can, could, might, may, will)

- |                          |                          |
|--------------------------|--------------------------|
| • John could sing.       | • *John sing could.      |
| • John has sung.         |                          |
| • John was singing.      |                          |
| • John could have sung.  | • *John have could sing. |
| • John has been singing. | • *John was having sung. |
| • John could have sung.  | • *John has could sung.  |

Some Rules:

Aux -> (m) (have) (be)

S -> NP Aux VP

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## Yes-No Questions

- |                          |                           |
|--------------------------|---------------------------|
| • John could sing.       | • Could John sing?        |
| • John has sung.         | • Has John sung?          |
| • John was singing.      | • Was John singing?       |
| • John could have sung.  | • Could John have sung?   |
| • John had been singing. | • Had John been singing?  |
| • John could have sung.  | • Could John have sung?   |
|                          | • *Have John could sing?  |
|                          | • *Been John had singing? |

Transformational rule:

Given a declarative sentence with helping verbs, form a Y/N Q by moving the first helping verb to the left of the subject

## Could we do it with phrase structure rule?

$$S \rightarrow \left\{ \begin{array}{l} \left\{ M - NP - (have) \right\} - be \\ have - NP \\ be - NP \end{array} \right\} - VP$$

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## English Verbal Inflection

A verbal following a modal always assumes its uninflected form

John could  $\left\{ \begin{array}{l} \text{sing} \\ * \text{singing} \\ * \text{sang} \end{array} \right\}$

Amy could  $\left\{ \begin{array}{l} \text{have} \\ * \text{has} \\ * \text{had} \end{array} \right\}$  gone

Sue must  $\left\{ \begin{array}{l} \text{be} \\ * \text{been} \\ * \text{was} \end{array} \right\}$  working

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## English Verbal Inflection II

- The perfect helping verb have requires the verbal element following it to be in its past-participle form

John has  $\left\{ \begin{array}{l} \text{sung} \\ * \text{sing} \\ * \text{singing} \end{array} \right\}$

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## English Verbal Inflection III

- The progressive helping verb be requires the verbal element following it to be in its present-participle form

John is  $\left\{ \begin{array}{l} \text{singing} \\ * \text{sung} \\ * \text{sing} \end{array} \right\}$

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## English Verbal Inflection IV

- The verbal element immediately to the right of the subject is inflected for tense and, except for modals, also for number and person of the subject
  - They like music. (pres)
  - They liked music. (past)
  - We are eating.
  - We were eating.
  - We have been singing.
  - We had been singing.
  - We could be singing.
  - We can be singing.

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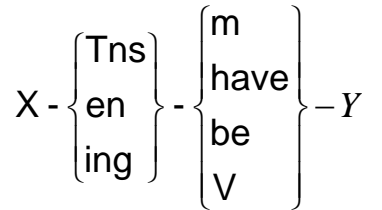
## English Verbal Inflection

- Information about the inflection should be associated with the verb that introduces it (not with the verb it attaches to).
- Tense marker should always be first

Aux = Tns (m) (have en) (be ing)

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## Affix Hopping – put endings where they belong



1-----2-----3-----4

⇒ 1,0,3 + 2,4 (obligatory)

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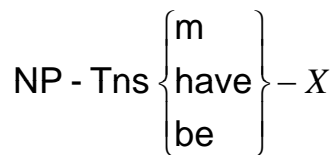
## Y/N Questions with tense

- Note: the moved constituent seems to carry the tense

- Would he go?
- \*Will he went?
- Has he been working?
- \*Have he is working?

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## Subject-Aux Inversion (2<sup>nd</sup> Preliminary Version)



1-----2-----3

⇒ 2 + 1,0,3 (optional)

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## What happens when no modal/have/be?

- Fred past arrive at the party →  
past Fred arrive at the party

Do Support:

An occurrence of Tns that has not been able to undergo affix hopping must have do inserted to the left of it (obligatory)

- Do+past Fred arrive at the party →  
Did Fred arrive at the party.

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## OK - That wasn't too hard...

- All of the above things can be understood with a transformational analysis – but it is reasonable to write context-free rules that capture what we see.
- Other kinds of constructions make that a bit more difficult... wh-questions and relative clauses. Let's take a look...

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## Wh-Questions

Wh-Questions are introduced with some wh-word

What could Mary be singing?

What did you find?

Who has eaten the cake?

What did you find the dog on?

Whose dog was the man bitten by?

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## Wh-Questions - Observations

1. Many show the same type of inverted word order of subject helping verb as we saw with y/n questions

What could Mary be singing?	Could Mary be singing something?
What did you find?	Did you find something?
*What you find?	
Who has eaten the cake?	Has someone eaten the cake?
Who found a dog?	???
Whose dog was the man bitten by?	Was the man bitten by the dog?
*Whose dog the man was bitten by?	

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## Wh-Questions

2. The questioned constituent, even though it appears at the beginning of a question, is actually "understood" as fulfilling some function within the sentence

What could Mary be singing?	Mary could be singing <u>a song</u> .
What did you find?	I found <u>a dog</u> .
Who has eaten the cake?	<u>Mary</u> has eaten the cake.
What did you find the dog on?	I found the dog on <u>the pillow</u> .
Whose dog was the man bitten by?	The man was bitten by <u>John's dog</u> .

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## The Transformational Story

- The sentence started out as a regular question and then:
  - Subject-aux inversion was applied to turn it into a y/n question
  - One of the NP's was moved up to the front of the sentence (this was a wh-np)

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## Subject-Aux Inversion

$$Q - NP - Tns \left\{ \begin{array}{l} m \\ have \\ be \end{array} \right\} - X$$

$$1 - - 2 - - - - 3 - - - - - 4$$

$$\Rightarrow 1,3 + 2,0,4 (optional)$$

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## Question Movement

$$Q - X - [det y]_{wh} - NP - Z$$

$$1 - - 2 - - - - 3 - - - - - 4$$

$$\Rightarrow 1 + 3, 2, 0, 4 (obligatory)$$

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## Relative Clauses

Clauses that further specify an NP – usually introduced by a relative pronoun – who, whom, which, that

- The police recovered the car that Fred stole.
- The hat John was wearing made Sheila laugh.
- The man who took the money ran away.
- The safe that the man took the money from was broken.

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## Relative Clauses

Let's look at the clauses themselves...

- The police recovered the car that Fred stole.
  - \*Fred stole
  - Fred stole **the car**
- The hat John was wearing made Sheila laugh.
  - \*John was wearing
  - John was wearing **the hat**
- The man who took the money ran away.
  - \* took the money
  - **The man** took the money
- The safe that the man took the money from was broken.
  - \*The man took the money from
  - The man took the money from **the safe**

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## Transformational Story

- Deep structure has the whole sentence there (modifying the NP) – relative clause formation has us delete it (and perhaps add the relative pronoun).
- Non-transformational story – when you hit a relative pronoun – you expect to parse a sentence with a hole in it – that hole needs to be filled with the NP that is being modified by the relative clause...

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