# Ling 566 Nov 23, 2010 <br> Auxiliaries 

## Overview

- What are auxiliaries?
- General properties of auxiliaries
- Lexical type/lexical entries for auxiliaries
- NICE properties (lexical rules)


## What Auxiliaries Are

- Sometimes called "helping verbs," auxiliaries are little words that come before the main verb of a sentence, including forms of be, have, do, can, could, may, might, must, shall, should, will, and would
- They tend to be involved in the expression of time, necessity, possibility, permission, and obligation, as well as such things as negation, affirmation, and questioning


## Some Basic Facts about Auxiliaries

- They are optional Pat tapdanced. Pat can tapdance. Pat is tapdancing.
- They precede any non-auxiliary verbs
*Pat tapdance can. *Pat tapdancing is.
- They determine the form of the following verb
*Pat can tapdancing. *Pat is tapdance.
- When they co-occur, their order is fixed Pat must be tapdancing. *Pat is musting tapdance.
- Auxiliaries of any given type cannot iterate *Pat could should tapdance.


## A Little History

- Chomsky's first book, Syntactic Structures (1957), contained a detailed analysis of the English system of auxiliary verbs
- It showed how formal analysis could reveal subtle generalizations
- The power of Chomsky's analysis of auxiliaries was one of the early selling points for transformational grammar
- Especially, his unified treatment of auxiliary do
- So it's a challenge to any theory of grammar to deal with the same phenomena


## Two Approaches to Analyzing Auxiliaries

- Treat auxiliaries as a special category, and formulate specialized transformations sensitive to their presence
- Assimilate their properties to existing types as much as possible, and elaborate the lexicon to handle what is special about them
- We adopt the latter, treating auxiliaries as a subtype of srv-lxm


## Consequences of Making auxv-lxm a Subtype of srv-lxm

- Auxiliaries should express one-place predicates
- Auxiliaries should allow non-referential subjects (dummy there, it, and idiom chunks)
- Passivization of the main verb (the auxiliary's complement) should preserve truth conditions
- Are these borne out?


## Why call auxiliaries verbs?

- be, have, and do exhibit verbal inflections (tense, agreement)
- be, have, and do can all appear as main verbs (that is, as the only verb in a sentence)
- Their inflections are the same in main and auxiliary uses
- be exhibits auxiliary behavior, even in its main verb uses
- Modals (can, might, will, etc.) don't inflect, but they occur in environments requiring a finite verb with no (other) finite verb around.


## What's special about auxiliaries?

- Unlike other subject-raising verbs we have looked at, their complements aren't introduced by to
- The modals and do have defective paradigms
- There are restrictions on the ordering and iterability of auxiliaries
- They have a set of special characteristics known as the NICE properties.


## Some Type Constraints

| TYPE | features/constranis | 1 IST |
| :---: | :---: | :---: |
|  |  |  |
| \%-lmm |  | verblur |
| $i_{\text {cossrblam }}$ |  | sroblmm |
|  | $[\operatorname{syn}[$ Head $[\operatorname{Aux}++]]$ | srobe |

## A Lexical Entry for be

$\left\langle\right.$ be,$\left.\left.\left.\left[\begin{array}{llll}\text { auxv-lxm } & & & \\ \text { ARG-ST } & \langle\mathrm{X}, & {\left[\begin{array}{lll}\text { SYN } & {\left[\begin{array}{lll}\text { HEAD } & \text { PRED } & +\end{array}\right]} \\ \text { SEM } & {[\text { INDEX }} & \text { Z }]\end{array}\right]}\end{array}\right]\right\rangle\right\rangle\right\rangle$

## The Entry for $b e$, with Inherited Information



## Entry for have

|  | auxv-lxm |
| :---: | :---: |
| / have | $\left.\operatorname{ARG-ST}\left\langle\mathrm{X},\left[\begin{array}{l} \text { SYN }\left[\operatorname{HEAD}\left[\begin{array}{ll} \text { verb } & \\ \text { FORM } & \mathrm{psp} \end{array}\right]\right. \end{array}\right]\right\rangle\right\rangle$ |
|  | $\operatorname{SEM}\left[\begin{array}{llc}\text { INDEX } & s \\ \text { RESTR } & \left\langle\left(\begin{array}{lc}\text { RELN } & \text { have } \\ \text { SIT } & s \\ \text { ARG } & \square\end{array}\right]\right.\end{array}\right]$ |

- Note the FORM restriction on the complement VP
- What accounts for the analogous FORM restriction on verbs following be?


## Lexical Entry for a Modal



- Note the restriction on the form of the complement VP
- What inflectional lexical rules apply to this lexeme?


## Accounting for the Basic Facts Cited Earlier

- Optionality of auxiliaries:

As raising verbs, their subjects and complements go together.

- Auxiliaries precede non-auxiliary verbs:

Auxiliaries are heads, and complements follow heads in English.

- Auxiliaries determine the form of the following verb:

This is built into their lexical entries.

- When auxiliaries co-occur, their order is fixed:

Different explanations for different combinations; see next slide.

- Non-iterability of auxiliaries:

Ditto.

## Accounting for Restrictions on Order and Iterability

- Order
- Modals are finite, and all auxiliaries take non-finite complements. Hence, modals must come first.
- Stative verbs (like own) don't have present participles, and auxiliary have is stative. Hence, *Pat is having tapdanced.
- Iterability
- Auxiliary be is also stative, so *Pat is being tapdancing.
- Modals must be finite, and their complements must be base, so *Pat can should tapdance.
- *Pat has had tapdanced can be ruled out in various ways, e.g. stipulating that auxiliary have has no past participle.


## Sketch of Chomsky's Old Analysis



## How this Analysis Handles the Basic Facts

- Optionality of auxiliaries: Stipulated in the phrase structure rule (with parentheses)
- Auxiliaries precede non-auxiliary verbs:

Built into the phrase structure rule, with AUX before VP

- Auxiliaries determine the form of the following verb: Inflections are inserted with the auxiliaries and moved onto the following verb transformationally.
- When auxiliaries co-occur, their order is fixed:

Stipulated in the phrase structure rule for AUX

- Non-iterability of auxiliaries:

Ditto.

## The two analyses assign very different trees



- could have been VP, have been VP, and been VP are all constituents
- could have been is not a constituent

- could have been VP, have been VP, and been VP are not constituents
- could have been is a constituent


## Ellipsis and Constituency

- Consider:

Pat couldn't have been eating garlic, but Chris could have been Pat couldn't have been eating garlic, but Chris could have Pat couldn't have been eating garlic, but Chris could

- On the nested analysis, the missing material is a (VP) constituent in each case
- On the flat analysis, the missing material is never a constituent
- This argues for our analysis over the old transformational one.


## Our Analysis of Auxiliaries So Far

- Auxiliaries are subject-raising verbs
- Most basic distributional facts about them can be handled through selectional restrictions between auxiliaries and their complements (that is, as ARG-ST constraints)
- Auxiliaries are identified via a HEAD feature AUX, which we have not yet put to use


## Descriptive Summary of the NICE Properties

Negation

Inversion
Contraction
Ellipsis

Sentences are negated by putting not after the first auxiliary verb; they can be reaffirmed by putting too or so in the same position

Questions are formed by putting an auxiliary verb before the subject NP

Auxiliary verbs take negated forms, with $n^{\prime} t$ affixed

Verb phrases immediately following an auxiliary verb can be omitted

## Negation (and Reaffirmation)

- Polar adverbs (sentential not, so, and too) appear immediately following an auxiliary
Pat will not leave
Pat will SO leave
Pat will TOO leave
- What about examples like Not many people left?
- What happens when you want to deny or reaffirm a sentence with no auxiliary?
Pat left
Pat did not leave
Pat did TOO leave


## The Auxiliary do

- Like modals, do only occurs in finite contexts:
*Pat continued to do not leave
- Unlike modals, do cannot be followed by other auxiliaries:
*Pat did not have left


## The $\mathrm{ADV}_{\text {pol }}$-Addition Lexical Rule



## What does the type pi-rule mean?

- It maps words to words (hence, "post-inflectional")
- It preserves MOD values, HEAD values as a default, and (like other lexical rule types) SEM values as a default


## Why doesn't $\mathrm{ADV}_{\text {pol }^{\prime} \text {-Addition LR mention VAL? }}$



## What is the role of these indices?



## Which nots does the rule license?

Andy must not have been sleeping? Andy must have not been sleeping? Andy must have been not sleeping? Kleptomaniacs cannot not steal. Kleptomaniacs cannot not steal.

## Negation and Reaffirmation: A Sample Tree



## Inversion

- Yes-no questions begin with an auxiliary: Will Robin win?
- The NP after the auxiliary has all the properties of a subject
- Agreement: Have they left? vs. *Has they left?
- Case: *Have them left?
- Raising: Will there continue to be food at the meetings?
- What happens if you make a question out of a sentence without an auxiliary?
Robin won
Did Robin win?


## The Inversion Lexical Rule



## How the Rule Yields Inverted Order


...plus the ARP

## The Feature INV

- What is the INV value of inputs to the Inversion LR?
- Perhaps surprisingly, the input is [INV +]
- Word-to-word rules (pi-rules) have default identity of HEAD features, and no INV value is given on the input
- Then what work is the feature doing?
- It's used to mark auxiliaries that can't or must be inverted You better watch out vs. *Better you watch out I shall go (shall ~'will') vs. Shall I go? (shall ~ 'should')


## Other Cases of Inversion

- Inversion is not limited to questions
- Preposed negatives: Never have I been so upset!
- Conditionals: Had we known, we would have left.
- Exclamations: May your teeth fall out!
- Does our rule account for these?
- No. Our rule's output says [MODE ques]. And each construction has slightly different idiosyncrasies.
- How might we extend our analysis to cover them?
- Define a type of inversion lexical rules, sharing certain properties, but with some differences.


## Inversion: A Sample Tree



## Contraction

- There are several types of contraction in English, but we're only talking about words ending in $n ' t$
- It may seem like just not said fast, but there's more to it
- Only finite verbs can take $n \not t$ :
*Terry must haven't seen us
- There are morphological irregularities:
won't, not *willn't \%shan't, not *shalln't
mustn't pronounced mussn't
don't pronounced doen't, not dewn't
*amn't


## The Contraction Lexical Rule



## Most of the work is in the semantics



## Why?

## What does POL do?


*We can'tn't stop
*They won't TOO mind

## Contraction: Sample Tree



## Ellipsis

- Ellipsis allows VPs to be omitted, so long as they would have been preceded by an auxiliary Pat couldn't have been watching us, but Chris could have been watching us.
- Unlike the other NICE properties, this holds of all auxiliaries, not just finite ones.
- What is the elliptical counterpart to a sentence with no auxiliary?

Whenever Pat watches TV, Chris watches TV Whenever Pat watches TV, Chris does

## The Ellipsis Lexical Rule

$$
\begin{aligned}
& \text { 「d-rule }
\end{aligned}
$$

$$
\begin{aligned}
& \text { OUTPUT } \left.\left\langle ⿴ 囗 十 \text {, } \begin{array}{ll}
\text { dervv-lxm } \\
\operatorname{ARG-ST} & \langle ⿴ 囗
\end{array}\right]\right\rangle
\end{aligned}
$$

－Note that this is a derivational LR（d－rule）－－that is， lexeme－to－lexeme
－This means that SYN and SEM are unchanged，by default

## Ellipsis: A Sample Output

| $\langle\text { could }$ | [auxv-lxm |  |
| :---: | :---: | :---: |
|  | SYN | $\left[\right.$ HEAD $\left[\begin{array}{ll}\text { FORM } & \text { fin } \\ \text { AUX } & + \\ \text { POL } & - \\ \text { AGR } & 1\end{array}\right]$ |
|  | ARG-ST | $\begin{aligned} & {\left[\begin{array}{ll} \text { VAL } & {\left[\begin{array}{ll} \operatorname{SPR} & \left\langle\left[\begin{array}{ll} \text { AGR } \end{array}\right]\right\rangle \end{array}\right]} \\ \langle\mathrm{NP}\rangle \end{array}\right.} \end{aligned}$ |
|  |  | $\left[\begin{array}{cc}\text { MODE } & \text { prop } \\ \text { INDEX } & s_{1}\end{array}\right.$ |
|  | SEM | $\left[\operatorname{RESTR}\left\langle\begin{array}{l}\text { RELN }\end{array}\right.\right.$ |

## Ellipsis: A Sample Tree



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## Semantics of Ellipsis S



What is the SEM value of the S node of this tree?
$\left[\begin{array}{lll}\text { INDEX } & s_{1} & \\ \text { MODE } & \text { prop } \\ \text { RESTR } & \left.\left\langle\begin{array}{ll}\text { RELN } & \text { name } \\ \text { NAME } & \text { Kim } \\ \text { NAMED } & i\end{array}\right],\left[\begin{array}{ll}\text { RELN } & \text { could } \\ \text { SIT } & s_{1} \\ \text { ARG } & s_{2}\end{array}\right]\right\rangle\end{array}\right]$

Note: $s_{2}$ has to be filled in by context.

## Infinitival to Revisited

- VP Ellipsis can occur after to:

We didn't find the solution, but we tried to.

- This is covered by our Ellipsis LR if we say to is [AUX +].
- Since AUX is declared on type verb, it follows that to is a verb.


## do Revisited

- Chomsky's old analysis: in sentences w/o auxiliaries...
- Tense can get separated from the verb in various ways
- Negation/Reaffirmation inserts something between Tense and the following verb
- Inversion moves Tense to the left of the subject NP
- Ellipsis deletes what follows Tense
- When this happens, $d o$ is inserted to support Tense
- Our counterpart:
- NICE properties hold only of auxiliaries
- do is a semantically empty auxiliary, so negated, reaffirmed, inverted, and elliptical sentences that are the semantic counterparts to sentences w/o auxiliaries are ones with $d o$.


## Summary

- Our analysis employs straightforward mechanisms
- Lexical entries for auxiliaries
- 3 new features (AUX, POL, INV)
- 4 lexical rules
- We handle a complex array of facts
- co-occurrence restrictions (ordering \& iteration)
- the NICE properties
- auxiliary do
- combinations of NICE constructions

