



# Multiple Auxiliaries in English

Oliver Calder

# What do they do?

- Modify the primary verb
    - Tense
      - { past, present, future }
    - Aspect
      - { simple, perfect, progressive, perfect progressive }
    - Mood
      - { indicative, imperative, conditional, subjunctive }
-

# Our Current Rules:

VC → AuxP VC

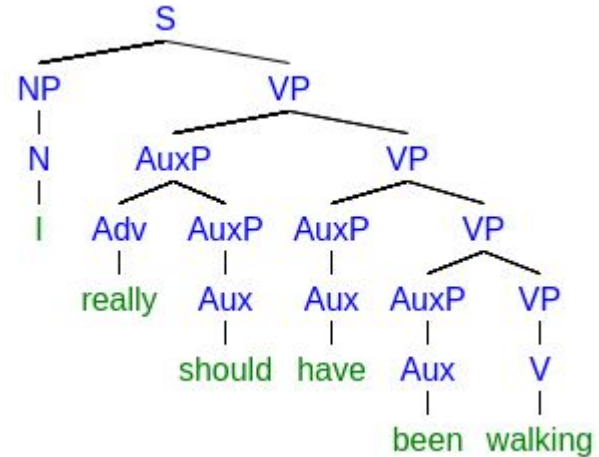
AuxP → Adv AuxP || AuxP Adv

AuxP → Aux

VC → V

\*\*\*For the sake of this presentation, “VC” and “verb clusters” both refer to [auxiliaries + verbs] after being stripped of all other NPs, PPs, etc.

“I should really have been walking”





# Pros and Cons

## Pros:

- Most grammatical verb clusters can be expressed
  - Few local counterexamples
  - (Infinitives and passives are exceptions)
- It is concise and straightforward

## Cons:

- It *vastly* overgenerates
    - Countless global counterexamples
- \*I having was been am walk.
- \*I will should had being walked.
- \*I be can am could will walking.

## Conclusion:

- Verb clusters have very strict rules. (This is good.)

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## Goals:

1. Define rules for construction of syntactically “correct” verb clusters
  - a. Based on tense and aspect
  - b. Implemented through tense of individual “Aux’s” and combinations of specific “syntactic verbs”
2. Limit both local and global counterexamples

### Not goals:

1. Develop rules for interaction with external elements (ie. PPs, NPs, etc.)
2. Worry about infinitives
3. Worry about Mood of sentence (indicative, subjunctive, imperative, ...)



## All verb cluster formats in English:

to walk	<b>Present</b>	<b>Past</b>	<b>Future</b>
<b>Simple</b>	walk	walked	will walk
<b>Perfect</b>	have walked	had walked	will have walked
<b>Progressive</b>	am walking	was walking	will be walking
<b>Perfect Progressive</b>	have been walking	had been walking	will have been walking



# All verbs are either Pres, Past, or Prog

Present  
Past  
Progressive  
Auxiliary

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
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# Tense of first verb indicates tense of VC

Present  
Past  
Progressive  
Auxiliary

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
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Initial patterns:

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# Future tense = “will” + Present tense

Present  
Past  
Progressive  
Auxiliary

to walk	Present	Future
<b>Simple</b>	walk	will + walk
<b>Perfect</b>	have walked	will + have walked
<b>Progressive</b>	am walking	will + be walking
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Initial patterns:

- Tense of first verb indicates tense of VC
- Future tense = Aux + Present tense

## All verb cluster formats in English:

Present  
Past  
Progressive  
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to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
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ie. not Prog

# First verb must be either Pres or Past

Present  
Past  
Progressive  
Auxiliary

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# “Aux” vs “Verb”

Given:

Future tense = “will” + Present tense

Therefore:

Other tense = Aux + Present tense

ie. Conditional = “would” + Present

- The word “will” does not have multiple tenses
- “will” cannot stand on its own

<b>Infinitive</b>	<b>Present</b>	<b>Past</b>	<b>Prog.</b>
“to have”	have	had	having
“will ___”	will	?	?

“will” can be replaced by other auxiliaries:

should	be walking
shall	walk
might	have walked
would	be walking
can	have been walking

Initial patterns:

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- Future tense = Aux + Present tense
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Order is: [Aux] → FirstV → [Past] → [Prog]

Present  
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Initial patterns:

- Tense of first verb indicates tense of VC
- Future tense = Aux + Present tense
- First verb must be either Present or Past (ie. not Prog.)
- Order is: [Aux] → FirstV → [past] → [progressive]

Present  
Past  
Progressive  
Auxiliary

## All verb cluster formats in English:

to walk	Present	Past	Future
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## Initial Rules:

VC → AuxP PresVC

VC → PresVC

VC → PastVC

Initial patterns:

- Tense of first verb indicates tense of VC
- Future tense = Aux + Present tense
  - Other Aux's can be used in place of "will"
- First verb must either present or past (ie. not Prog.)
  - If there is an Aux, first verb must be present tense

Order is:

- [Aux] → FirstV → [PastV] → [ProgV]



## Initial Rules:

VC → AuxP PresVC

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PresVC → PresV ProgV

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PastVC → PastV

PastVC → PastV ProgV

PastVC → PastV PastVC (*oh no!*)

Initial patterns:

- Tense of first verb indicates tense of VC
- Future tense = Aux + Present tense
  - Other Aux's can be used in place of "will"
- First verb must either present or past (ie. not Prog.)
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Order is:

- [Aux] → FirstV → [PastV] → [ProgV]

Maximum two PastVs in a row: "I had been walking"



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PastVC → PastV PastVC'

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- Future tense = Aux + Present tense
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$\text{PresVC} \rightarrow \text{PresV PastVC}$

$\text{PastVC} \rightarrow \text{PastV}$

$\text{PastVC} \rightarrow \text{PastV ProgV}$

$\text{PastVC} \rightarrow \text{PastV PastVC}'$

$\text{PastVC}' \rightarrow \text{PastV}$

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## Things that are bad about initial rules:

- While PresVC and PastVC exist, there is no ProgVC (because there need not be one... but this is inconsistent)



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- Only PastVC gets a primed PastVC' to indicate that it can't go to another PastVC, which is again inconsistent





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## Replacing PastVC rules with:

- $\text{PastVC} \rightarrow \text{PastV PastVC}'$
- $\text{PastVC} \rightarrow \text{PastVC}'$

would be bad as well, since any PastV would have to pass through  $\text{PastVS} \rightarrow \text{PastVC}'$  even if antirecursion not needed



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Do they even work?



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PastVC → PastV

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PastVC → PastV PastVC'

PastVC' → PastV

PastVC' → PastV ProgV

Do they even work?

- I will have been walking my dog to the store

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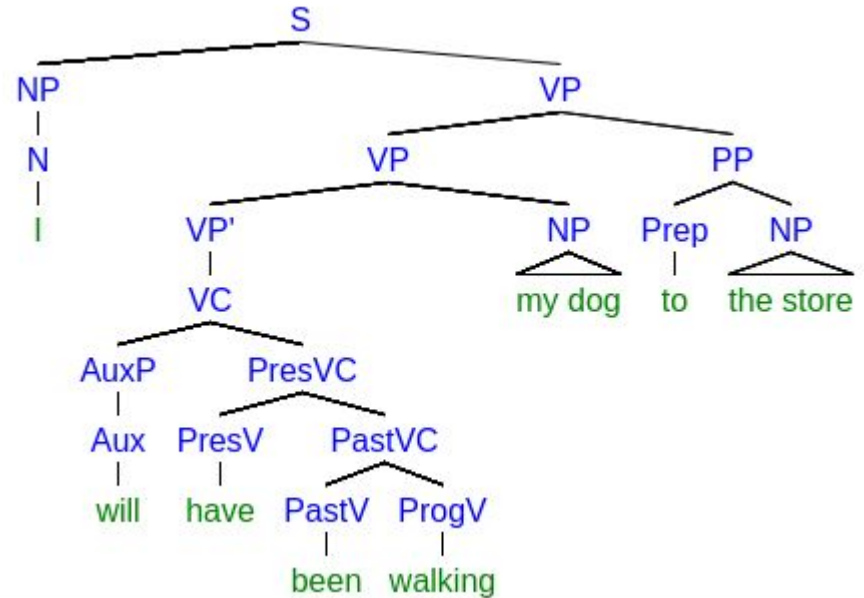
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Do they even work?

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Do they even work?

- I will have been walking my dog to the store
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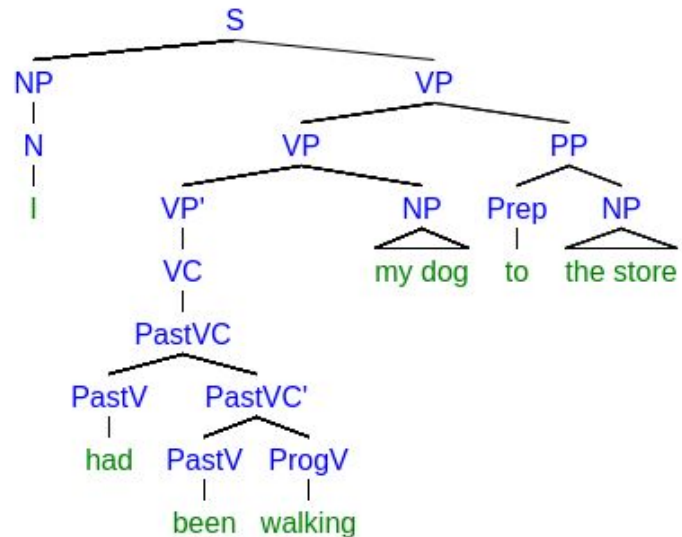
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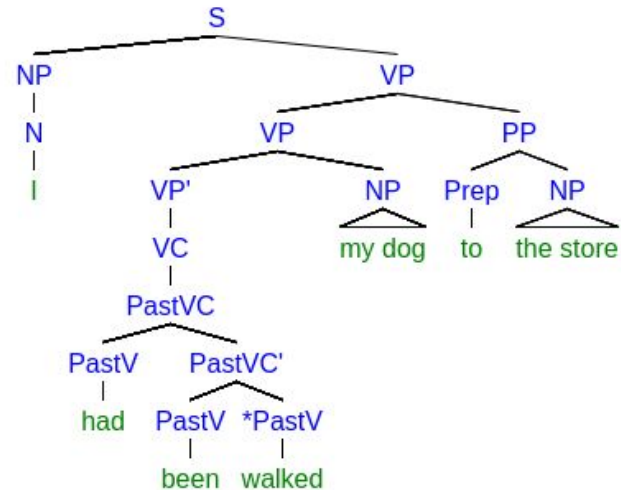
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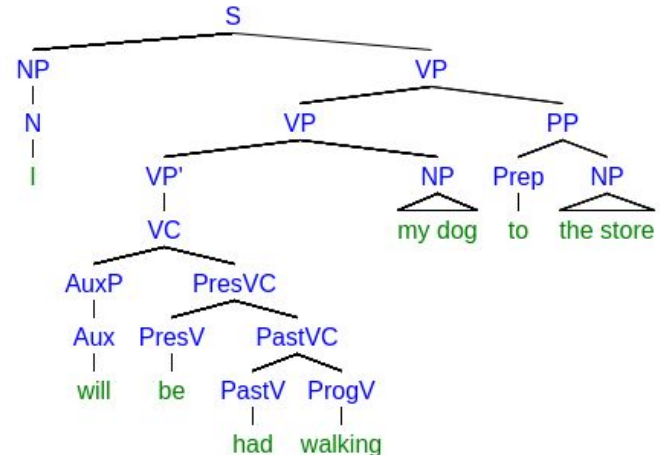
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- \*I had been walked my dog to the store
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## Do they even work?

- I will have been walking my dog to the store
- I had been walking my dog to the store
- \*I had been walked my dog to the store
- \*I will be had walking my dog to the store ✗
  - Oh no!
  - Global counterexample



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Why did the rules successfully account for

I will have been walking my dog to the store □

but not for

\*I will be had walking my dog to the store ✗



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The verbs “to have” and “to be” play syntactic roles



The verbs “*to have*” and “*to be*”  
play syntactic roles

---

# All verb cluster formats in English:

Present  
Past  
Progressive  
Auxiliary

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
<b>Perfect</b>	have walked	had walked	will have walked
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## “Syntactic Verbs” marked:

“to have”  
“to be”

Present

Past

Progressive

Auxiliary

to walk	Present	Past	Future
Simple	walk	walked	will walk
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Progressive	am walking	was walking	will be walking
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“to have”  
“to be”

Present

Past

Progressive

Auxiliary

## Clusters organized by verb:

to walk	Present	Past	Future
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"to have"  
"to be"

Present

Past

Progressive

Auxiliary

## "to have" always followed by PastVC

to walk	Present	Past	Future
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<b>Perfect</b>	<i>have</i> walked	<i>had</i> walked	will <i>have</i> walked
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<b>Perfect Progressive</b>	<i>have</i> been walking	<i>had</i> been walking	will <i>have</i> been walking

Further patterns:

- “to have” always followed by PastVC

“to have”  
“to be”

Present  
Past  
Progressive  
Auxiliary

## All verb cluster formats in English:

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<b>Perfect Progressive</b>	have been walking	had been walking	will have been walking

“to have”  
“to be”

Present

Past

Progressive

Auxiliary

## ProgV always preceded by “to be”

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
<b>Perfect</b>	<i>have</i> walked	<i>had</i> walked	will <i>have</i> walked
<b>Progressive</b>	<b>am</b> walking	<b>was</b> walking	will <b>be</b> walking
<b>Perfect Progressive</b>	<i>have</i> <b>been</b> walking	<i>had</i> <b>been</b> walking	will <i>have</i> <b>been</b> walking

Further patterns:

- “to have” always followed by PastVC
- ProgV always preceded by “to be”

“to have”  
“to be”

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**The aspect (perfect,  
progressive, both) requires  
specific verbs in specific orders**

—

**Specific verbs as necessary  
constituents of aspect-specific  
verb clusters**

—



# New rules for aspect-based VCs:

Given:

- “*to have*” always followed by PastVC
- ProgV always preceded by “*to be*”

Possible aspects:

- Simple
- Perfect
- Progressive
- Perfect + Progressive



# New rules for aspect-based VCs:

PerfVC → HaveV PastVC

Given:

- “*to have*” always followed by PastVC
- ProgV always preceded by “*to be*”

Possible aspects:

- Simple: [nothing] + main verb
- Perfect: have + main verb
- Progressive: be + main verb
- Perfect + Progressive: have + be + main verb



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Possible aspects:

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- **Perfect:** **have + main verb**
- Progressive: be + main verb
- **Perfect + Progressive:** **have + be + main verb**



## New rules for aspect-based VCs:

~~PerfVC → HaveV PastVC~~  
PerfVC → HaveV PastV  
PerfProgVC → HaveV PastProgVC

Given:

- “to have” always followed by PastVC
- ProgV always preceded by “to be”

Possible aspects:

- Simple: [nothing] + main verb
- **Perfect:** **have + main verb**
- Progressive: be + main verb
- **Perfect + Progressive:** **have + be + main verb**



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PerfVC → HaveV PastV

PerfProgVC → HaveV PastProgVC

Given:

- “to have” always followed by PastVC
- ProgV always preceded by “to be”

Possible aspects:

- Simple: [nothing] + main verb
- Perfect: have + main verb
- Progressive: be + main verb
- Perfect + Progressive: have + be + main verb



## New rules for aspect-based VCs:

PerfVC → HaveV PastV

PerfProgVC → HaveV PastProgVC

Given:

- “to have” always followed by PastVC
- **ProgV** always preceded by “to be”

Possible aspects:

- Simple: [nothing] + main verb
- Perfect: have + main verb
- Progressive: be + main verb
- Perfect + Progressive: have + be + main verb





## New rules for aspect-based VCs:

PerfVC → HaveV PastV

PerfProgVC → HaveV PastProgVC

ProgVC → BeV ProgV

Given:

- “to have” always followed by PastVC
- **ProgV** always preceded by “to be”

Possible aspects:

- Simple: [nothing] + main verb
- Perfect: have + main verb
- Progressive: be + main verb
- Perfect + Progressive: have + be + main verb



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:


Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

## Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  PresV  
VC  $\rightarrow$  PresPerfVC  
VC  $\rightarrow$  PresPerfProgVC  
VC  $\rightarrow$  PresProgVC

VC  $\rightarrow$  PastV  
VC  $\rightarrow$  PastPerfVC  
VC  $\rightarrow$  PastPerfProgVC  
VC  $\rightarrow$  PastProgVC


## Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC  
  
ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  PresV  
VC  $\rightarrow$  PresPerfVC  
VC  $\rightarrow$  PresPerfProgVC  
VC  $\rightarrow$  PresProgVC

VC  $\rightarrow$  PastV  
VC  $\rightarrow$  PastPerfVC  
VC  $\rightarrow$  PastPerfProgVC  
VC  $\rightarrow$  PastProgVC

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

T  $\in$  {Pres, Past}

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

T  $\in$  {Pres, Past}

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

T  $\in$  {Pres, Past}

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV





# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

T  $\in$  {Pres, Past}

TPerfVC  $\rightarrow$  THaveV PastV

TPerfProgVC  $\rightarrow$  THaveV  
PastProgVC

TProgVC  $\rightarrow$  TBeV ProgV

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

T  $\in$  {Pres, Past}

TPerfVC  $\rightarrow$  THaveV PastV

TPerfProgVC  $\rightarrow$  THaveV  
PastProgVC

TProgVC  $\rightarrow$  TBeV ProgV

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  AuxP PresPerfVC  
VC  $\rightarrow$  AuxP PresPresPerfVC  
VC  $\rightarrow$  AuxP PresProgVC

VC  $\rightarrow$  TV  
VC  $\rightarrow$  TPerfVC  
VC  $\rightarrow$  TPerfProgVC  
VC  $\rightarrow$  TProgVC

$T \in \{\text{Pres, Past}\}$

TPerfVC  $\rightarrow$  THaveV PastV

TPerfProgVC  $\rightarrow$  THaveV  
PastProgVC

TProgVC  $\rightarrow$  TBeV ProgV

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  TV  
VC  $\rightarrow$  AuxP PresAVC  
VC  $\rightarrow$  TAVC

$T \in \{\text{Pres, Past}\}$   
 $A \in \{\text{Perf, PerfProg, Prog}\}$

TPerfVC  $\rightarrow$  THaveV PastV

TPerfProgVC  $\rightarrow$  THaveV  
PastProgVC

TProgVC  $\rightarrow$  TBeV ProgV

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV



# Synthesis of tense-based and aspect-based rules:

PerfVC  $\rightarrow$  HaveV PastV  
PerfProgVC  $\rightarrow$  HaveV PastProgVC

ProgVC  $\rightarrow$  BeV ProgV

Synthesized Rules:

VC  $\rightarrow$  TV  
VC  $\rightarrow$  AuxP PresAVC  
VC  $\rightarrow$  TAVC

T  $\in$  {Pres, Past}  
A  $\in$  {Perf, PerfProg, Prog}

TPerfVC  $\rightarrow$  THaveV PastV

TPerfProgVC  $\rightarrow$  THaveV  
PastProgVC

TProgVC  $\rightarrow$  TBeV ProgV

Initial Rules:

VC  $\rightarrow$  AuxP PresVC  
VC  $\rightarrow$  PresVC  
VC  $\rightarrow$  PastVC

PresVC  $\rightarrow$  PresV  
PresVC  $\rightarrow$  PresV ProgV  
PresVC  $\rightarrow$  PresV PastVC

PastVC  $\rightarrow$  PastV  
PastVC  $\rightarrow$  PastV ProgV  
PastVC  $\rightarrow$  PastV PastVC'

PastVC'  $\rightarrow$  PastV  
PastVC'  $\rightarrow$  PastV ProgV

**What about passives?**

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## Active

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
<b>Perfect</b>	have walked	had walked	will have walked
<b>Continuous</b>	am walking	was walking	will be walking
<b>Perfect Continuous</b>	have been walking	had been walking	will have been walking

“to have”  
“to be”

Present

Past

Progressive

Auxiliary

## Passive

to walk	Present	Past	Future
<b>Simple</b>	am walked	was walked	will be walked
<b>Perfect</b>	have been walked	had been walked	will have been walked
<b>Continuous</b>	am being walked	was being walked	will be being walked
<b>Perfect Continuous</b>	have been being walked	had been being walked	will have been being walked

Active vs. Passive

## Active

to walk	Present	Past	Future
<b>Simple</b>	walk	walked	will walk
<b>Perfect</b>	have walked	had walked	will have walked
<b>Continuous</b>	am walking	was walking	will be walking
<b>Perfect Continuous</b>	have been walking	had been walking	will have been walking

“to have”  
“to be”

Present

Past

Progressive

Auxiliary

## Passive

to walk	Present	Past	Future
<b>Simple</b>	am walked	was walked	will be walked
<b>Perfect</b>	have been walked	had been walked	will have been walked
<b>Continuous</b>	am being walked	was being walked	will be being walked
<b>Perfect Continuous</b>	have been being walked	had been being walked	will have been being walked

Active vs. Passive



Passives replace final verb with  
“*to be*” in proper tense,  
followed by main verb in past  
tense

---



# Rules for Passives

Active Rules:

$VC \rightarrow TV$

$VC \rightarrow \text{AuxP PresAVC}$

$VC \rightarrow \text{TAVC}$

$T \in \{\text{Pres, Past}\}$

$A \in \{\text{Perf, PerfProg, Prog}\}$

$\text{TPerfVC} \rightarrow \text{THaveV PastV}$

$\text{TPerfProgVC} \rightarrow \text{THaveV}$   
 $\text{PastProgVC}$

$\text{TProgVC} \rightarrow \text{TBeV ProgV}$



# Rules for Passives

Active Rules:

$VC \rightarrow T\underline{V}$

$VC \rightarrow \text{AuxP PresA}\underline{VC}$

$VC \rightarrow T\underline{A}\underline{VC}$

$T \in \{\text{Pres, Past}\}$

$A \in \{\text{Perf, PerfProg, Prog}\}$

$T\text{Perf}\underline{VC} \rightarrow T\text{HaveV } \underline{\text{PastV}}$

$T\text{PerfProg}\underline{VC} \rightarrow T\text{HaveV}$   
 $\text{PastProg}\underline{VC}$

$T\text{Prog}\underline{VC} \rightarrow T\text{BeV } \underline{\text{ProgV}}$



# Rules for Passives

$TPassiveVC \rightarrow TBeV \text{ Past}V$   
 $ProgPassiveVC \rightarrow ProgBeV \text{ Past}V$

Active Rules:

$VC \rightarrow T\underline{V}$   
 $VC \rightarrow AuxP \text{ Pres}A\underline{VC}$   
 $VC \rightarrow T\underline{A}VC$

$T \in \{\text{Pres}, \text{Past}\}$   
 $A \in \{\text{Perf}, \text{PerfProg}, \text{Prog}\}$

$TPerf\underline{VC} \rightarrow THaveV \underline{\text{Past}V}$

$TPerfProg\underline{VC} \rightarrow THaveV$   
 $\text{Past}Prog\underline{VC}$

$TProg\underline{VC} \rightarrow TBeV \underline{\text{Prog}V}$

Passive Rules:

$VC \rightarrow T\underline{\text{Passive}VC}$   
 $VC \rightarrow AuxP \text{ Pres}A\underline{\text{Passive}VC}$   
 $VC \rightarrow T\underline{\text{APassive}VC}$

$T \in \{\text{Pres}, \text{Past}\}$   
 $A \in \{\text{Perf}, \text{PerfProg}, \text{Prog}\}$

$TPerf\underline{\text{Passive}VC} \rightarrow THaveV$   
 $\underline{\text{Past}PassiveVC}$

$TPerfProg\underline{\text{Passive}VC} \rightarrow$   
 $THaveV \text{ Past}Prog\underline{\text{Passive}VC}$

$TProg\underline{\text{Passive}VC} \rightarrow TBeV$   
 $\underline{\text{Prog}PassiveVC}$

**Difficult to create unified rules  
for Passives and Actives**

---



# Rules for Passives

$TPassiveVC \rightarrow TBeV \ PastV$   
 $ProgPassiveVC \rightarrow ProgBeV \ PastV$

Active Rules:

$VC \rightarrow TV$   
 $VC \rightarrow AuxP \ PresAVC$   
 $VC \rightarrow TAVC$

$T \in \{Pres, Past\}$   
 $A \in \{Perf, PerfProg, Prog\}$

$TPerfVC \rightarrow THaveV \ PastV$

$TPerfProgVC \rightarrow THaveV \ PastProgVC$

$TProgVC \rightarrow TBeV \ ProgV$

Passive Rules:

$VC \rightarrow TPassiveVC$   
 $VC \rightarrow AuxP \ PresAPassiveVC$   
 $VC \rightarrow TAPassiveVC$

$T \in \{Pres, Past\}$   
 $A \in \{Perf, PerfProg, Prog\}$

$TPerfPassiveVC \rightarrow THaveV \ PastPassiveVC$

$TPerfProgPassiveVC \rightarrow THaveV \ PastProgPassiveVC$

$TProgPassiveVC \rightarrow TBeV \ ProgPassiveVC$



# Test Active Sentence

Active Rules:

$VC \rightarrow TV$

$VC \rightarrow \text{AuxP PresAVC}$

$VC \rightarrow \text{TAVC}$

$T \in \{\text{Pres, Past}\}$

$A \in \{\text{Perf, PerfProg, Prog}\}$

$\text{TPerfVC} \rightarrow \text{THaveV PastV}$

$\text{TPerfProgVC} \rightarrow \text{THaveVPastProgVC}$

$\text{TProgVC} \rightarrow \text{TBeV ProgV}$

“I really should have been walking my dog to the park”

# Test Active Sentence

Active Rules:

VC → TV

VC → AuxP PresAVC

VC → TAVC

T ∈ {Pres, Past}

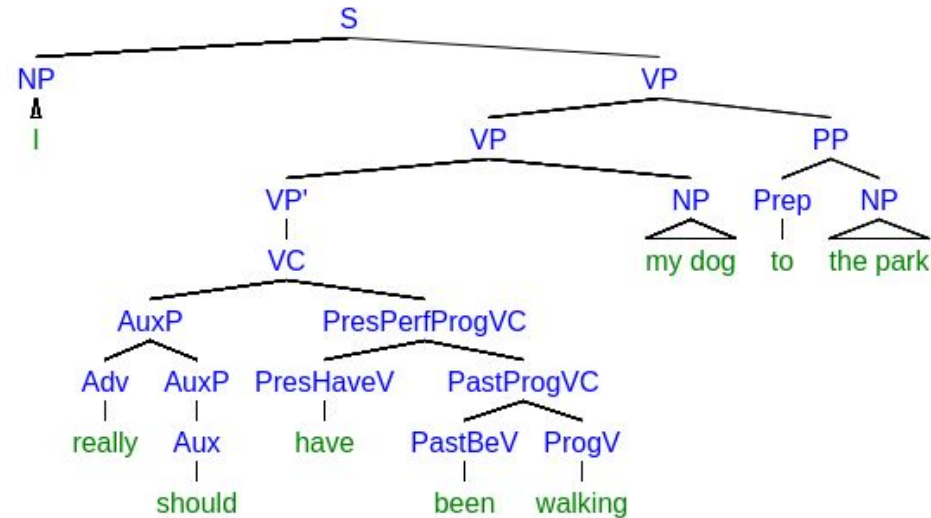
A ∈ {Perf, PerfProg, Prog}

TPerfVC → THaveV PastV

TPerfProgVC → THaveVPastProgVC

TProgVC → TBeV ProgV

“I really should have been walking my dog to the park”







# Test Passive Sentence

Passive Rules:      TPassiveVC  $\rightarrow$  TBeV PastV  
                         ProgPassiveVC  $\rightarrow$  ProgBeV PastV

VC  $\rightarrow$  TPassiveVC

VC  $\rightarrow$  AuxP PresAPassiveVC

VC  $\rightarrow$  TAPassiveVC

T  $\in$  {Pres, Past}

A  $\in$  {Perf, PerfProg, Prog}

TPerfPassiveVC  $\rightarrow$  THaveV PastPassiveVC

TPerfProgPassiveVC  $\rightarrow$  THaveV PastProgPassiveVC

TProgPassiveVC  $\rightarrow$  TBeV ProgPassiveVC

“My dog really should have been being walked to the park”

# Test Passive Sentence

Passive Rules: TPassiveVC → TBeV PastV  
 ProgPassiveVC → ProgBeV PastV

VC → TPassiveVC

VC → AuxP PresAPassiveVC

VC → TAPassiveVC

T ∈ {Pres, Past}

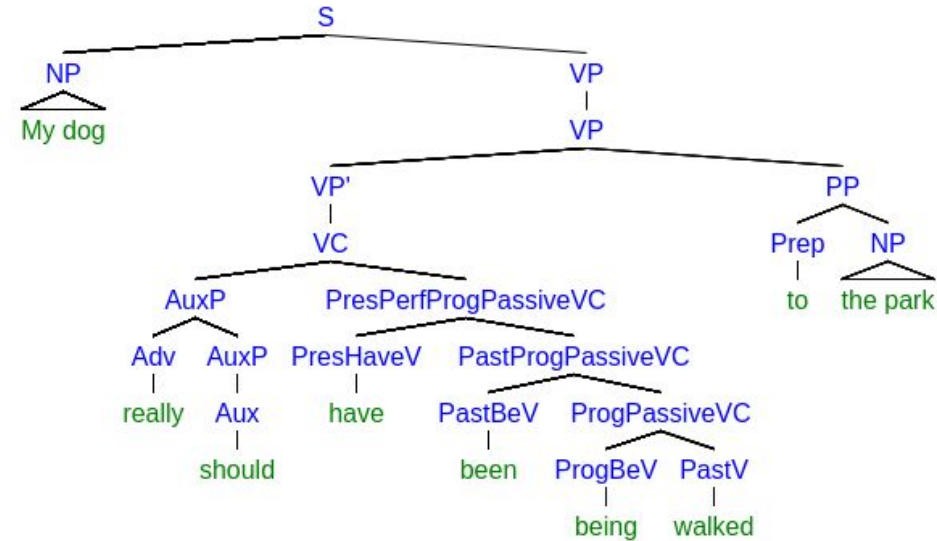
A ∈ {Perf, PerfProg, Prog}

TPerfPassiveVC → THaveV PastPassiveVC

TPerfProgPassiveVC → THaveV PastProgPassiveVC

TProgPassiveVC → TBeV ProgPassiveVC

“My dog really should have been being walked to the park”





# Limitations

- Very verbose



# Limitations

- Very verbose
- Must know the Tense/Aspect/Passivity of the verb cluster beforehand



# Limitations

- Very verbose
- Must know the Tense/Aspect/Passivity of the verb cluster beforehand
- Does not account for movement of Subject / Object NPs in passives



# Limitations

- Very verbose
- Must know the Tense/Aspect/Passivity of the verb cluster beforehand
- Does not account for movement of Subject / Object NPs in passives
- Does not account for infinitives



## Final Rules:

$TPassiveVC \rightarrow TBeV \ PastV$   
 $ProgPassiveVC \rightarrow ProgBeV \ PastV$

Active Rules:

$VC \rightarrow TV$   
 $VC \rightarrow AuxP \ PresAVC$   
 $VC \rightarrow TAVC$

$T \in \{Pres, Past\}$   
 $A \in \{Perf, PerfProg, Prog\}$

$TPerfVC \rightarrow THaveV \ PastV$

$TPerfProgVC \rightarrow THaveV$   
 $PastProgVC$

$TProgVC \rightarrow TBeV \ ProgV$

Passive Rules:

$VC \rightarrow TPassiveVC$   
 $VC \rightarrow AuxP \ PresAPassiveVC$   
 $VC \rightarrow TAPassiveVC$

$T \in \{Pres, Past\}$   
 $A \in \{Perf, PerfProg, Prog\}$

$TPerfPassiveVC \rightarrow THaveV$   
 $PastPassiveVC$

$TPerfProgPassiveVC \rightarrow$   
 $THaveV \ PastProgPassiveVC$

$TProgPassiveVC \rightarrow TBeV$   
 $ProgPassiveVC$