

The Syntactic Algebra of Adjuncts

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The Talk in a Nutshell

Neo-Davidsonian semantics: adjuncts are interpreted as **conjuncts**

- (1) a. John danced beautifully.
 b. $\exists e[\text{dance}(e, \text{john}) \wedge \text{beautiful}(e)]$

Take-Home Message

- Adjuncts behave syntactically like logical **and**, too.
- Properties of adjuncts give rise to grammaticality inferences.
- Adjunct Island Constraint and parasitic gaps follow from these inferences.

Outline

- 1 A Theory-Neutral Definition of Adjuncts
- 2 Adjuncts and Grammaticality Inferences
 - Characterizing Adjunct Languages
 - Adjunct Algebras
- 3 Empirical Implications
 - Deriving the AIC
 - Parasitic Gaps
 - Some Open Problems
- 4 Conclusion

Adjuncts in the Literature

Adjuncts ...

- have no special operational status (CG; Cinque 1999),
- are pair-merged (Chomsky 1995),
- are late-merged (Stepanov 2001),
- are inserted but not merged immediately (Hunter 2012),
- involve asymmetric feature checking (Frey and Gärtner 2002),
-

Problem

Can we abstract away from these details?

Properties that hold of every conceivable implementation?



Two Surface Properties of Adjuncts

- **Optionality**

Adjuncts can be omitted.

- (2) **(Obviously)** I will **(easily)** ace this **((very) challenging)** exam **(because I (really) am that smart)**.

- **Independence**

Independently well-formed adjuncts can be combined.

- (3) a. **Obviously** I will ace this exam.
 b. I will **easily** ace this exam.
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Definition (Adjuncts)

Phrase marker a is an **Adjunct** iff it is optional and independent.

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Adjunct Extension

What do these properties tell us about grammars with Adjuncts?
 What is the general shape of the **generated language**?

Definition (Adjunct Extensions)

Let **s** and **t** be (multi-dominance) trees.

Then **t** is an **Adjunct extension** of **s** for grammar G ($s <_G t$) iff **t** is the result of inserting one or more Adjuncts of G in **s**.

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- **Obviously** I will ace this exam $<_G$ **Obviously** I will **easily** ace this exam
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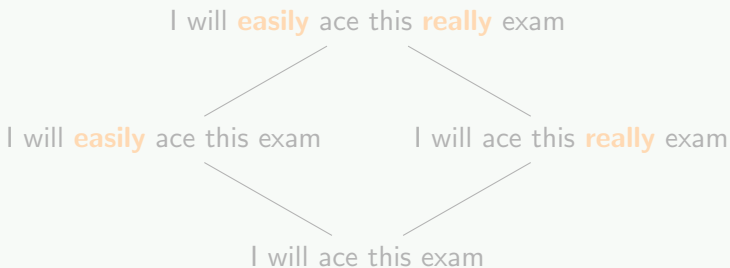
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Theorem (Optionality Closure)

If t is an Adjunct extension of s for G and G generates t , then G generates s .

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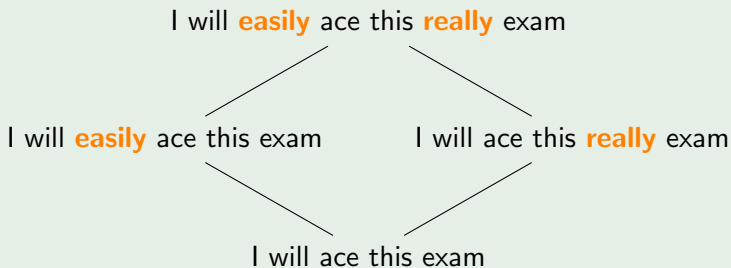


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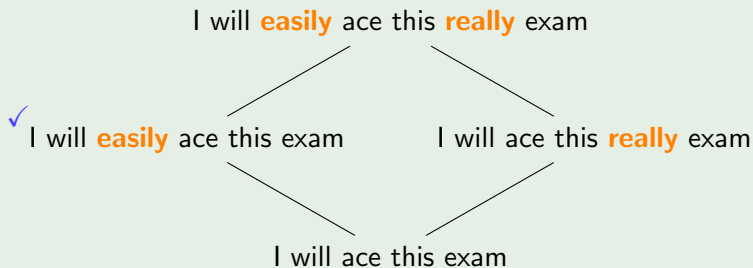


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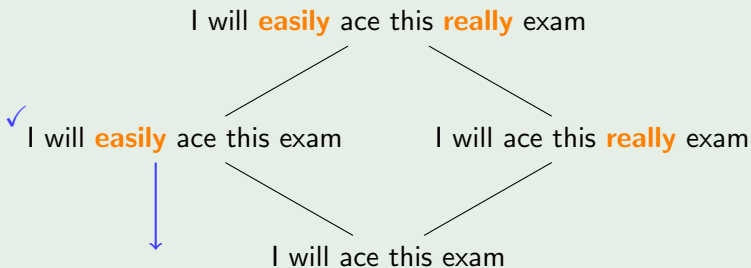


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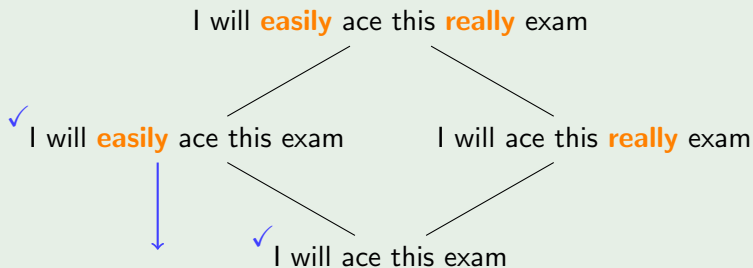


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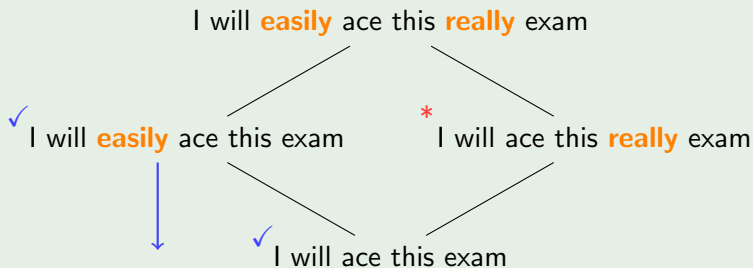


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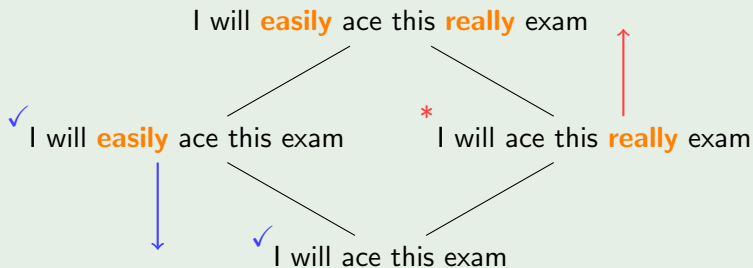


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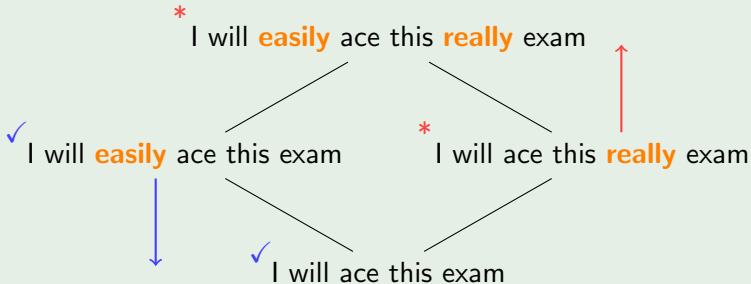


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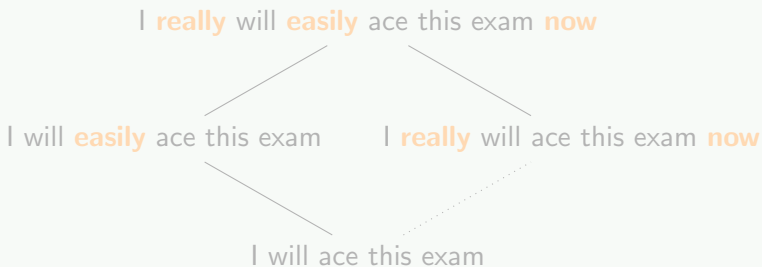


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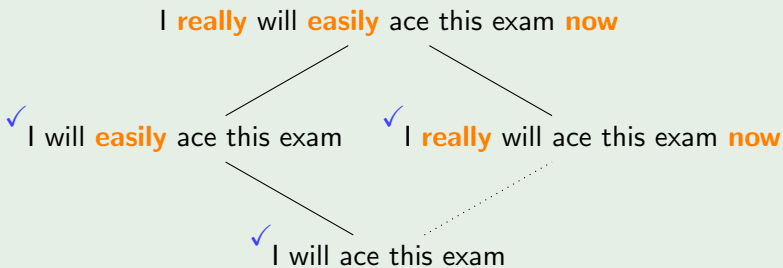


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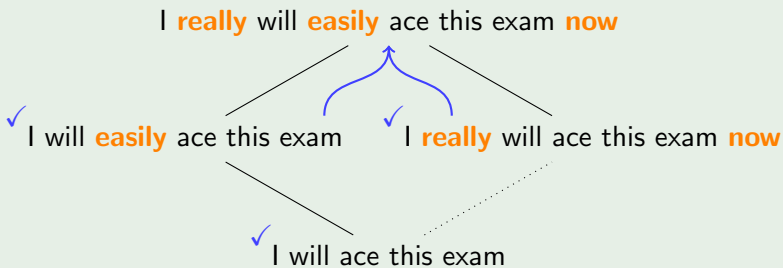


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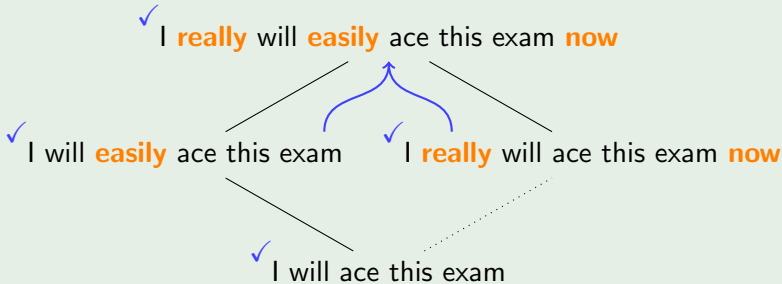


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Adjunct Algebra Induced by G

- Order the set of all possible (not necessarily grammatical) trees by G 's Adjunct extension relation.
- Add a dummy element \perp at the bottom.

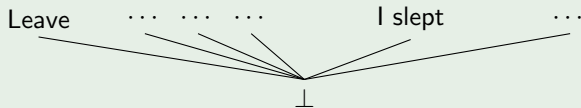
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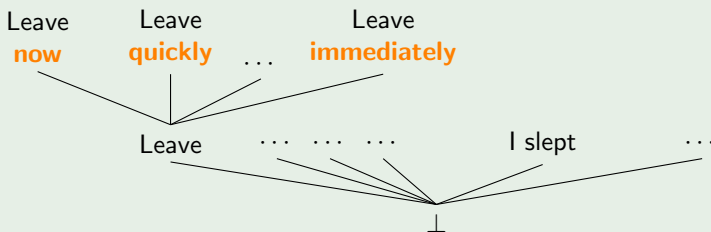
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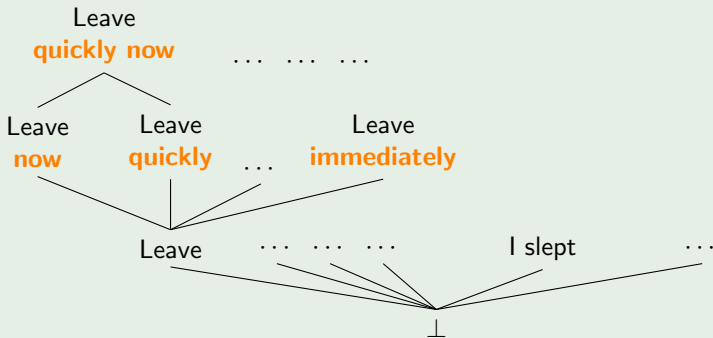
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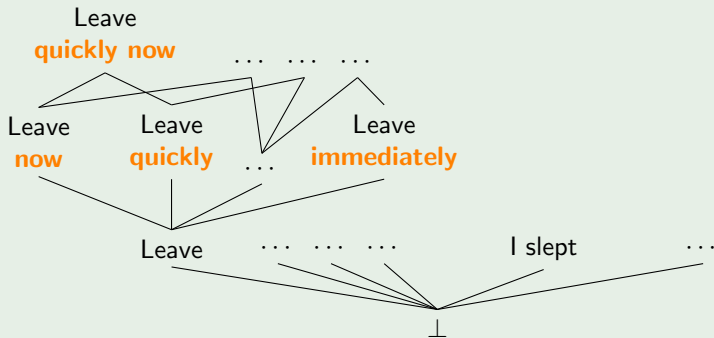
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Adjunct Languages are Collections of Ideals

Definition (Ideal)

A non-empty subset S of a poset $\langle A, \leq \rangle$ is an **ideal** iff

- for every $x \in S$, $y \leq x$ implies $y \in S$, and
- for all $x, y \in S$ there is some $z \in S$ such that $x \leq z$ and $y \leq z$.

Theorem

The tree language generated by grammar G is a collection of ideals over the Adjunct Algebra induced by G (modulo \perp).

Interim Summary

Any implementation of Adjunction that captures
Optionality and Independence yields a grammar formalism where

- \Downarrow grammaticality is downward entailing with respect to $<_G$,
- \Uparrow ungrammaticality is upward entailing with respect to $<_G$,
- \vee grammaticality is preserved under “fusion”.

Parallels to Logical And

- **Grammaticality is Downward Entailing**
 $a \wedge b = 1$ implies $a = 1$
- **Ungrammaticality is Upward Entailing**
 $a = 0$ implies $a \wedge b = 0$
- **Grammaticality is Preserved Under “Fusion”**
 $a \wedge b = 1$ and $a \wedge c = 1$ jointly imply $a \wedge b \wedge c = 1$

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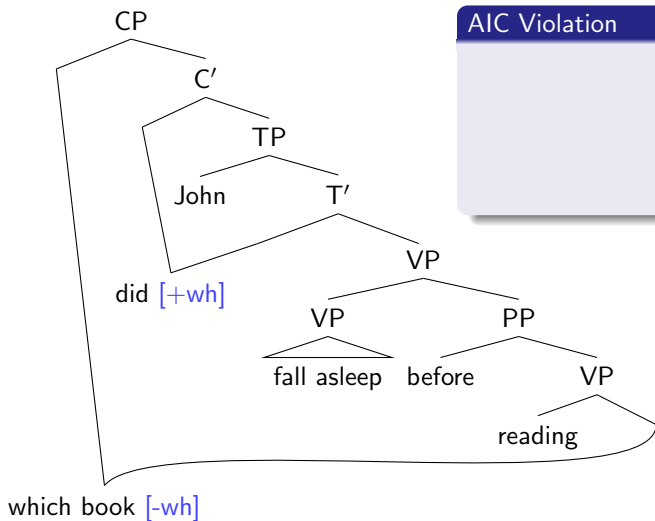
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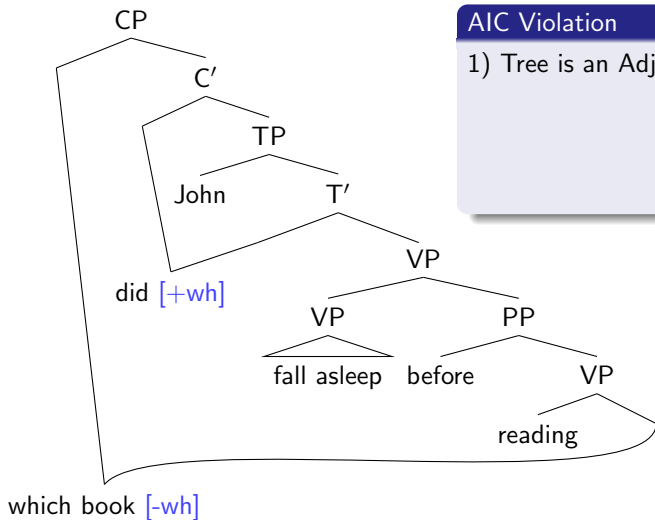
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The AIC follows from **optionality closure and feature checking**.



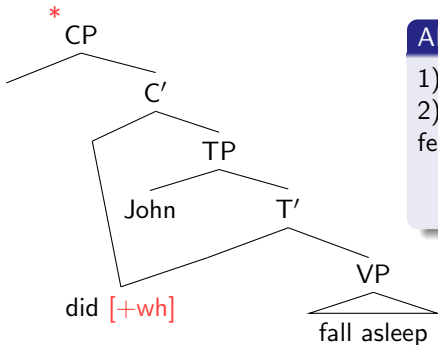
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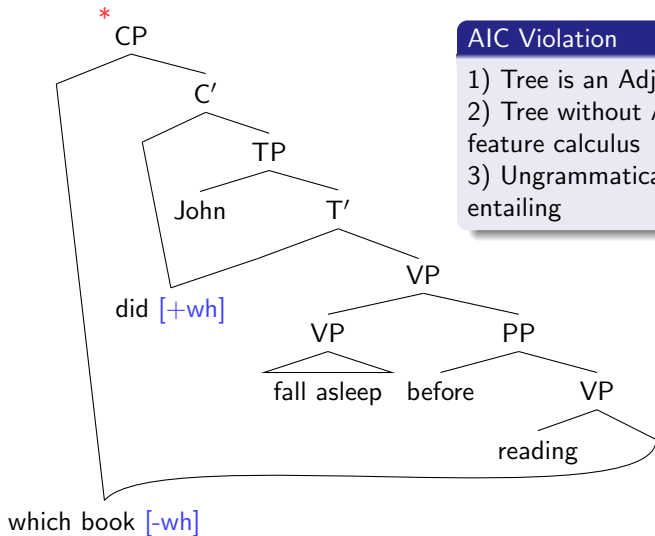


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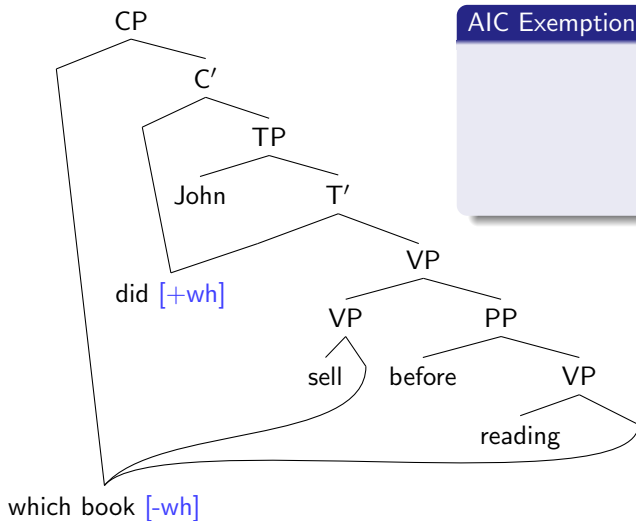


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- 3) Ungrammaticality is upward entailing

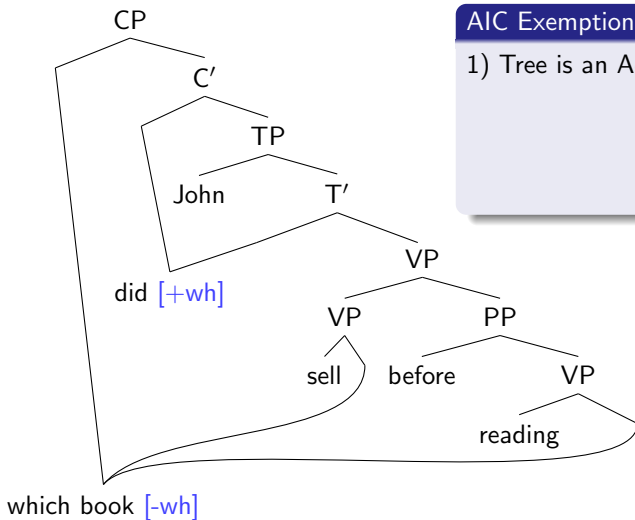
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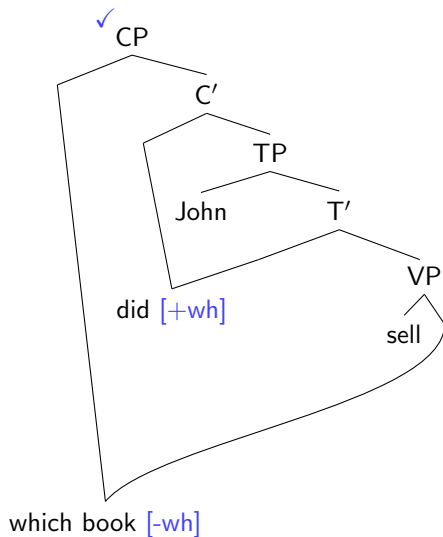


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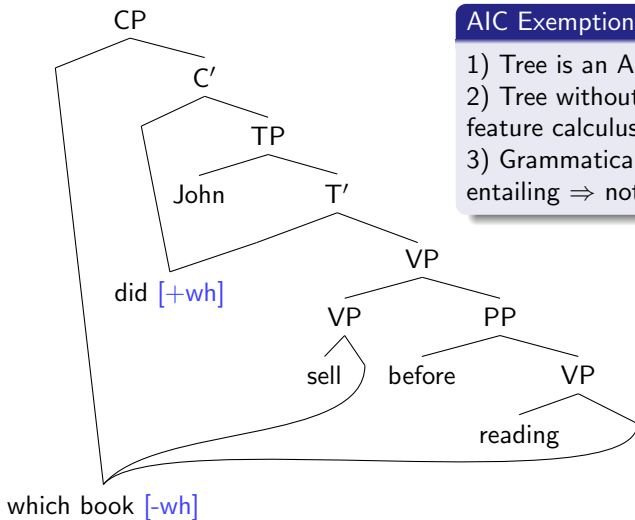


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AIC Exemption

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- 2) Tree without Adjunct satisfies feature calculus
- 3) Grammaticality isn't upward entailing \Rightarrow nothing follows

Why Parasitic Gaps are Idempotent

Multiple PGs may piggyback on a single mover.

- (4) Which movie did John **whilst mocking** throw in the trash **after watching**?

Follows from **independence closure**

- (5) a. Which movie did John **whilst mocking** throw in the trash?
b. Which movie did John throw in the trash **after watching**?

Not All adjuncts are Adjuncts

Some adjuncts can be extracted from (Truswell 2007):

(6) Which car did John drive Mary crazy **trying to fix**?

Truswell's event-based generalization \approx

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V2 in German

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Summary

- Adjuncts characterized by Optionality and Independence
 - enforces certain grammatical inferences
 - ↓ grammaticality is preserved under Adjunct removal
 - ↑ ungrammaticality is preserved under Adjunct insertion
 - ∨ grammaticality is preserved under Adjunct combination
- ⇒ AIC falls out naturally, yet allow for parasitic gaps

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Constraints through Operations

Constraints and operations are **closely connected**.

Theorem (Graf 2011; Kobele 2011)

A constraint can be expressed via Merge iff it can be computed using only a finitely bounded amount of working memory.

- **Intuition:** Use feature calculus to emulate how information flows through the tree during computation
- Doable for almost all constraints from the syntactic literature
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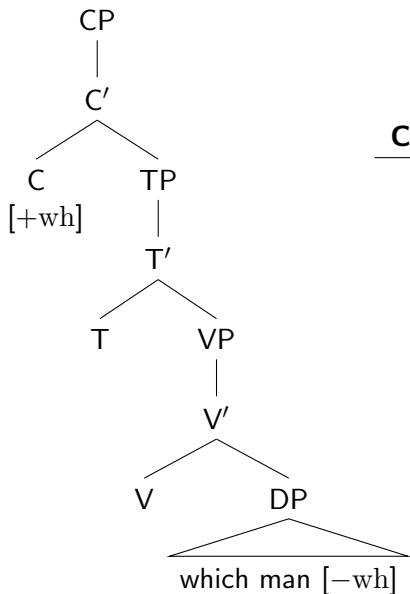
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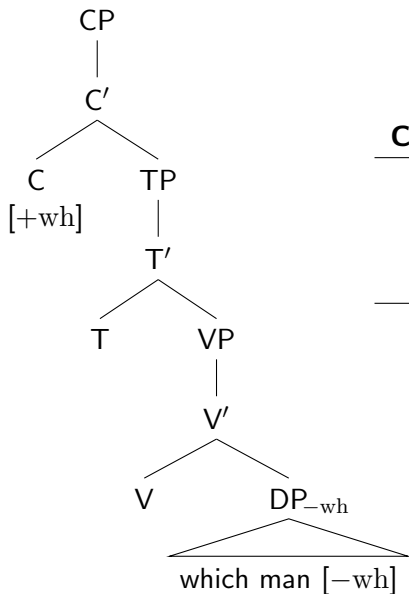
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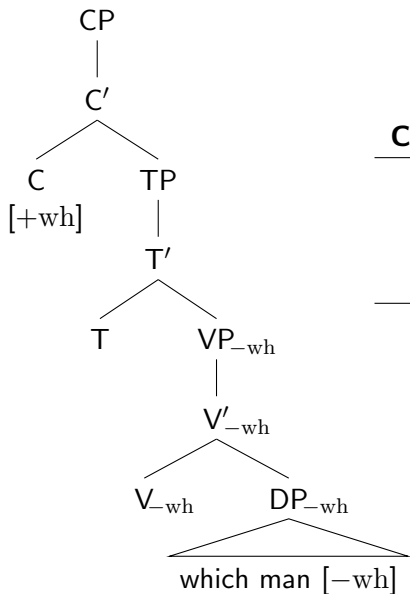
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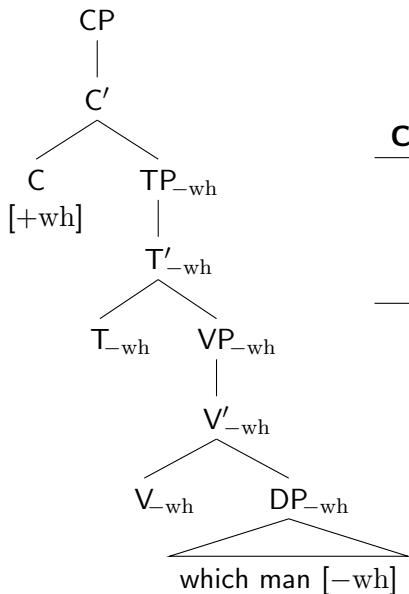
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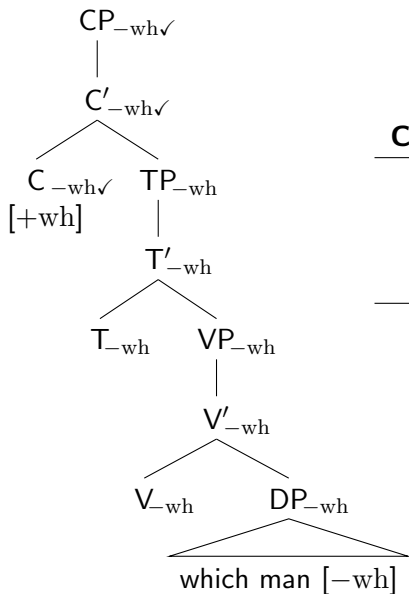
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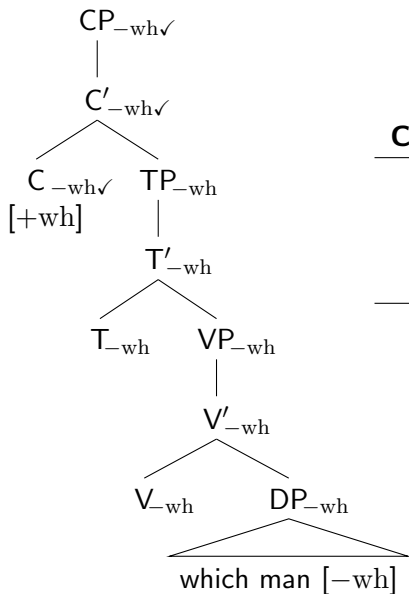
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V	D	T
T	V	C
C	T	V,N
D _{-wh}	N	V _{-wh}
V _{-wh}	D _{-wh}	T _{-wh}
T _{-wh}	V _{-wh}	

Example: Keeping Track of Movers



Category	Selects	Selected by
D	N	V
V	D	T
T	V	C
C	T	V,N
D _{-wh}	N	V _{-wh}
V _{-wh}	D _{-wh}	T _{-wh}
T _{-wh}	V _{-wh}	C _{-wh}
C _{-wh✓}	T _{-wh}	V,N

Example: Keeping Track of Movers



Category	Selects	Selected by
D	N	V
V	D	T
T	V	C
C	T	V,N
D _{-wh}	N	V _{-wh}
V _{-wh}	D _{-wh}	T _{-wh}
T _{-wh}	V _{-wh}	C _{-wh}
C _{-wh✓}	T _{-wh}	V,N
C _{-wh}	T _{-wh}	V _{-wh} , N _{-wh}

Adjuncts: The Price of Freedom

- Adjuncts very free due to Optionality and Independence
- Freedom reflected in feature calculus, limits information flow
⇒ feature calculus cannot emulate all constraints correctly

Semi-Permeability

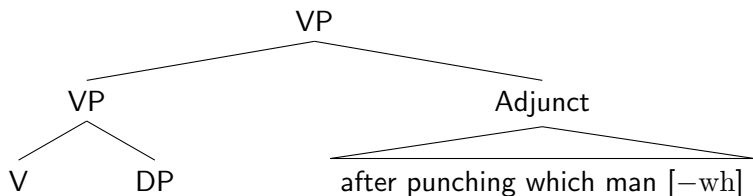
- Information flow into Adjuncts reliable
⇒ Adjuncts can put restrictions on shape of tree
(cf. parasitic gaps)
- Information flow out of Adjuncts unreliable
⇒ Adjuncts cannot be depended on

Adjunct \equiv black hole

Example: Adjunction a la Frey and Gärtner (2002)

Adjunction as Asymmetric Selection

Adjuncts select XP they adjoin to, but are not themselves selected.

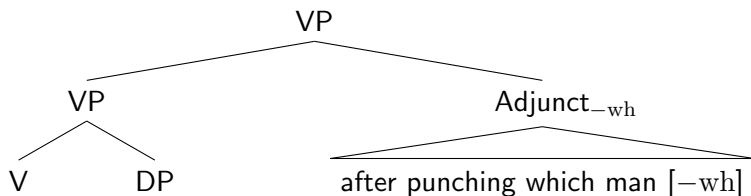


Category	Selects	Selected by
Adjunct	V	—
V	D	T

Example: Adjunction a la Frey and Gärtner (2002)

Adjunction as Asymmetric Selection

Adjuncts select XP they adjoin to, but are not themselves selected.

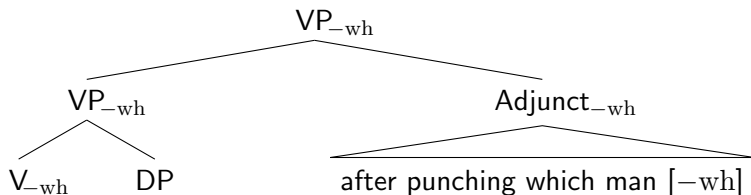


Category	Selects	Selected by
Adjunct	V	—
V	D	T
Adjunct _{-wh}	V	—

Example: Adjunction a la Frey and Gärtner (2002)

Adjunction as Asymmetric Selection

Adjuncts select XP they adjoin to, but are not themselves selected.

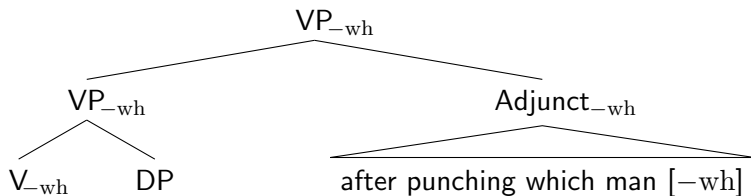


Category	Selects	Selected by
Adjunct	V	—
V	D	T
Adjunct _{-wh}	V _{-wh}	—
V _{-wh}	D	T _{-wh}

Example: Adjunction a la Frey and Gärtner (2002)

Adjunction as Asymmetric Selection

Adjuncts select XP they adjoin to, but are not themselves selected.



Category	Selects	Selected by
Adjunct	V	—
V	D	T
$Adjunct_{-wh}$	V_{-wh}	—
V_{-wh}	D	T_{-wh}