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. $\exists e[\text{dance}(e, \text{john}) \wedge \textbf{beautiful(e)}]$

Take-Home Message

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

Outline

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.
  c. **Obviously** I will **easily** ace this exam.

Definition (Adjuncts)

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

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**.

Example

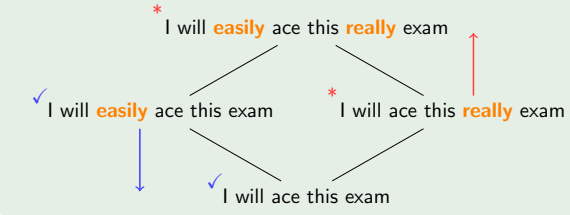
- **Obviously** I will ace this exam $<_G$ **Obviously** I will **easily** ace this exam
- I will ace this exam $<_G$ **Obviously** I will **easily** ace this exam
- **Obviously** I will ace this exam $\not<_G$ I will **easily** ace this exam
- I will ace this exam $\not<_G$ I will **easily** ace this test
- exam will this I ace $<_G$ **easily** exam will this I ace

Optionality Closure

Theorem (Optionality Closure)

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

Example

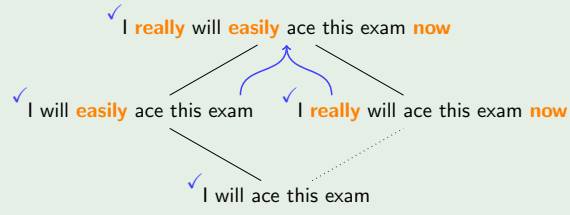


Independence Closure

Theorem (Independence Closure)

For **s** *and* **t** *adjunct extensions of some tree, G generates the "fusion" of* **s** *and* **t** *if it generates both* **s** *and* **t**.

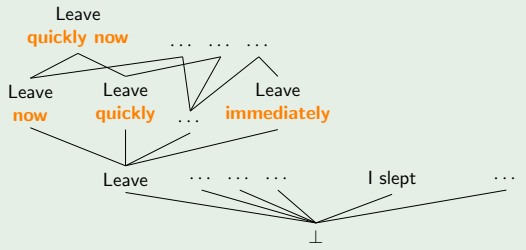
Example



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.

Example



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

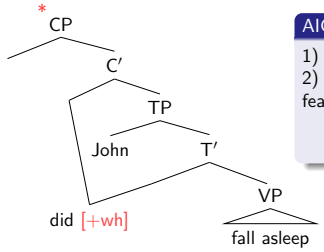
- $\Downarrow$ grammaticality is downward entailing with respect to $<_G$,
- $\Uparrow$ ungrammaticality is upward entailing with respect to $<_G$,
- $\vee$ grammaticality is preserved under "fusion".

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 $a \wedge b \wedge c = 1$

Deriving the AIC

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



AIC Violation

1) Tree is an Adjunct extension
2) Tree without Adjunct violates feature calculus

Deriving the AIC

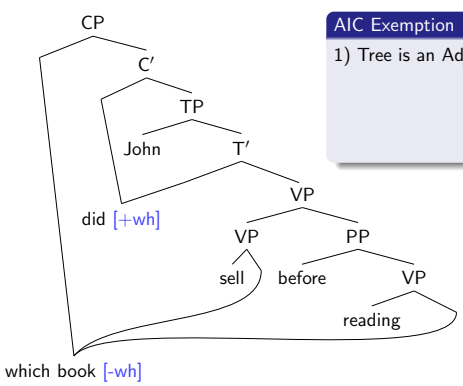
The AIC follows from **optionality closure and feature checking**.

AIC Violation

1) Tree is an Adjunct extension
2) Tree without Adjunct violates feature calculus
3) Ungrammaticality is upward entailing

Why Parasitic Gaps are Different

PGs piggyback on a **mandatory feature checker**.



AIC Exemption

1) Tree is an Adjunct extension

Why Parasitic Gaps are Different

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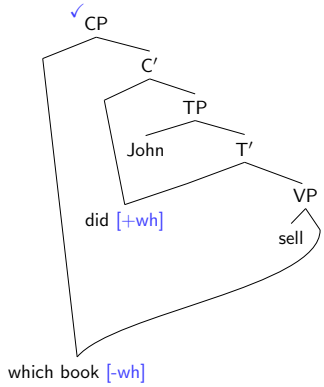

AIC Exemption

1) Tree is an Adjunct extension
2) Tree without Adjunct satisfies feature calculus

Why Parasitic Gaps are Different

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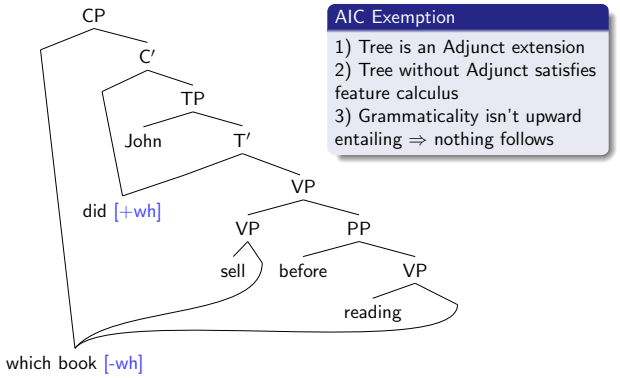


AIC Exemption

1) Tree is an Adjunct extension
2) Tree without Adjunct satisfies feature calculus
3) Grammaticality isn't upward entailing ⇒ 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 ≈
non-island adjuncts more tightly integrated semantically

	sem-argument	**sem-adjunct**
syn-adjunct	Truswell adjuncts	Adjuncts
syn-argument	arguments	ECM-marked adjuncts (?)

V2 in German

(7) a. **Gestern** hat der Hans die Maria geküsst.
yesterday has the Hans the Maria kissed
'Yesterday, John kissed Mary.'
b. Hat der Hans die Maria geküsst?
has the Hans the Maria kissed
'Did John kiss Mary?'
c. * Hat der Hans die Maria geküsst.
has the Hans the Maria kissed
'John kissed Mary.'

Possible Answers

- V2 is post-syntactic and thus irrelevant for Optionality.
- V1 is grammatical, but restricted by discourse factors (e.g. telling jokes).

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

References

Chomsky, Noam. 1995. *The minimalist program*. Cambridge, Mass.: MIT Press.

Cinque, Guglielmo. 1999. *Adverbs and functional heads: A cross-linguistic perspective*. Oxford: Oxford University Press.

Frey, Werner, and Hans-Martin Gärtner. 2002. On the treatment of scrambling and adjunction in minimalist grammars. In *Proceedings of the Conference on Formal Grammar (FGTrento)*, 41–52. Trento.

Graf, Thomas. 2011. Closure properties of minimalist derivation tree languages. In *LACL 2011*, ed. Sylvain Pogodalla and Jean-Philippe Prost, volume 6736 of *Lecture Notes in Artificial Intelligence*, 96–111. Heidelberg: Springer.

Hunter, Tim. 2012. Deconstructing merge and move to make room for adjunction. Under review.

Kobele, Gregory M. 2011. Minimalist tree languages are closed under intersection with recognizable tree languages. In *LACL 2011*, ed. Sylvain Pogodalla and Jean-Philippe Prost, volume 6736 of *Lecture Notes in Artificial Intelligence*, 129–144.

Stepanov, Arthur. 2001. Late adjunction and minimalist phrase structure. *Syntax* 4:94–125.

Truswell, Robert. 2007. Tense, events, and extraction from adjuncts. In *Proceedings of the 43rd Annual Meeting of the Chicago Linguistic Society*.

Constraints through Operations

Constraints and operations are **closely connected**.

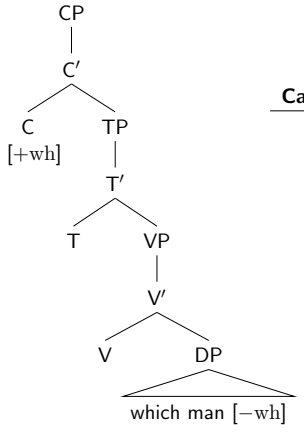
Theorem (Graf 2011; Kobele 2011)

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
- Relies on symmetry of c-selection (category features & selection features)

head-argument relation ≡ information pipeline

Example: Keeping Track of Movers



Category	**Selects**	**Selected by**
D	N	V
V	D	T
T	V	C
C	T	V,N

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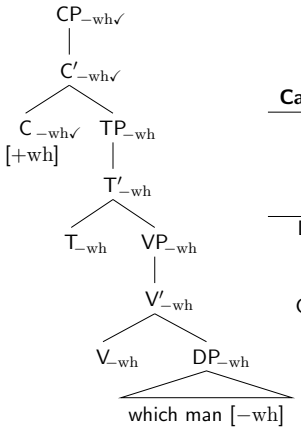


Category	Selects	Selected by
D	N	V
V	D	T
T	V	C
C	T	V,N
D$_{-wh}$	N	V$_{-wh}$
V$_{-wh}$	D$_{-wh}$	T$_{-wh}$
T$_{-wh}$	V$_{-wh}$	C$_{-wh}$
C$_{-wh\checkmark}$	T$_{-wh}$	V,N
C$_{-wh}$	T$_{-wh}$	V$_{-wh}$,N$_{-wh}$

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

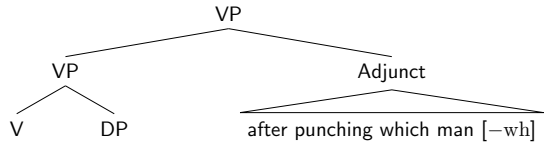
- Information flow into Adjuncts reliable
  ⇒ Adjuncts can put restrictions on shape of tree
  (cf. parasitic gaps)
- Information flow out of Adjuncts unreliable
  ⇒ Adjuncts cannot be depended on

Adjunct ≡ 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
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V	D	T

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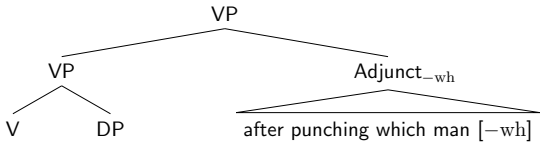

Category	Selects	Selected by
Adjunct	V	—
V	D	T
Adjunct$_{-wh}$	V	—

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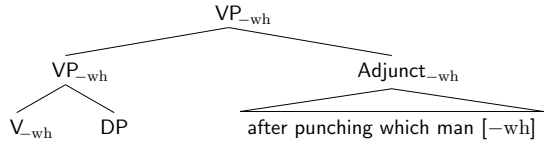

Category	Selects	Selected by
Adjunct	V	—
V	D	T
Adjunct$_{-wh}$	V$_{-wh}$	—
V$_{-wh}$	**D**	T$_{-wh}$