Adjuncts, Islands, Algebra
(with a Sprinkling of Semantics)

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The Strong Island Puzzle

Adjuncts and conjuncts are hard to extract from — why?

(1)  
   a. Which book did John complain that he lost?  
   b. * Which book did John complain because he lost?
   c. * Which book did John complain after losing?

(2)  
   * Which book does John like Ke$ha and the author of?

Mathematical Solution

- Island effects are an inevitable consequence of optionality.
- Non-islands lack optionality wrt syntax or semantics.
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Outline

1. Two Strong Islands
   - Adjuncts
   - Coordination

2. The Math: Optionality and Grammaticality Inferences
   - Ojuncts: Formalizing Optionality
   - Optionality Closure

3. Deriving Island Effects

4. How to Deal With Optional Non-Islands

5. Linking the Syntactic and Semantic Ojunct-Algebras
   - Semantic Algebra

6. Conclusion & Outlook
Adjuncts

- extraction usually blocked

(3) a. Which book did John complain that he lost \( t \)?
   b. * Which book did John complain \textbf{because he lost} \( t \)?
   c. * Which book did John complain \textbf{after losing} \( t \)?

- gaps licensed

(4) Which book did John burn \( t \) \textbf{after reading} \( e \)?

- usually optional

(5) (Obviously) I will (easily) ace this (\textbf{(very) challenging}) exam (because I (\textbf{really}) am that smart).
Coordination

- extraction usually blocked

  (6)  
  a. Ed brewed beer and Greg drank it.
  b. * Which beer did Ed brew t and Greg drink it? 
  c. * Which wine did Ed brew beer and Greg drink t?

- across-the-board extraction possible

  (7)  
  a. Which wine did Ed brew t and Greg drink t?

- mostly optional (modulo morphological/semantic agreement)

  (8)  
  a. Ed brewed beer and Greg drank it.
  b. Ed brewed beer.

  (9)  
  a. Ed and Greg are brewing beer.
  b. * Ed are brewing beer.

  (10) 
  a. Ed and Greg met.
  b. * Ed met.
The Big Picture

As a rule of thumb, adjuncts and coordinations

1. block extraction,
2. allow for gaps,
3. are optional.

The Big Question

Could (1) and (2) be related to optionality?
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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?
The notion of an **ojunct** provides an abstract characterization of optional phrase markers.

**Ojunct (Intuitive Definition)**

A phrase marker is an **ojunct** iff it is implemented by some operation that captures optionality.

Under most Minimalist conceptions of movement, **ojuncts are necessarily islands**:

**Theorem (Islandhood)**

*No ojunct can be extracted from if the extraction step involves checking a dependency at the target site.*
The notion of an ojunct provides an abstract characterization of optional phrase markers.

**Ojunct (Intuitive Definition)**

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No ojunct can be extracted from if the extraction step involves checking a dependency at the target site.
Due to optionality, grammars with ojuncts generate languages with a special **algebraic shape**.

**Definition (Ojunct Extensions)**

Let \( s \) and \( t \) be trees. Then \( t \) is an **ojunct extension** of \( s \) for grammar \( G \) (\( s <_G t \)) iff \( t \) is the result of inserting one or more ojuncts 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
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- **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 $<_G$ I will **easily** ace this exam

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  *I will easily* ace this exam

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Let \( s \) and \( t \) be trees. Then \( t \) is an **ojunct extension** of \( s \) for grammar \( G \) (\( s \prec_G t \)) iff \( t \) is the result of inserting one or more ojuncts of \( G \) in \( s \).

**Example**

- **Obviously** I will ace this exam \( \prec_G \) **Obviously** I will easily ace this exam
- I will ace this exam \( \prec_G \) **Obviously** I will easily ace this exam
- **Obviously** I will ace this exam \( \not\prec_G \) **I will easily** ace this exam
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**Example**

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

If \( t \) is an ojunct extension of \( s \) for \( G \) and \( G \) generates \( t \), then \( G \) generates \( s \).

Example

I will \textit{easily} ace this \textit{really} exam

I will \textit{easily} ace this exam

I will ace this \textit{really} exam

I will ace this exam
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I will \textbf{easily} ace this \textbf{really} exam

I will \textbf{easily} ace this exam \hspace{1cm} I will ace this \textbf{really} exam

I will ace this exam
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If $t$ is an ojunct extension of $s$ for $G$ and $G$ generates $t$, then $G$ generates $s$.

Example

I will **easily** ace this **really** exam

✓

I will **easily** ace this exam  
I will ace this **really** exam

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✓ I will easily ace this exam

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**Example**

I will **easily** ace this **really** exam

- I will **easily** ace this exam
- I will ace this **really** exam
- I will ace this exam
Characterizing Ojunct Languages

**Theorem (Optionality Closure)**

*If* \( t \) *is an ojunct extension of* \( s \) *for* \( G \) *and* \( G \) *generates* \( t \), *then* \( G \) *generates* \( s \).*

**Example**

- I will *easily* ace this *really* exam
  - ✓ I will *easily* ace this exam
  - ✓ I will ace this exam
  - * I will ace this *really* exam
  - ✓ I will ace this exam
Characterizing Ojunct Languages

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If \( t \) is an ojunct extension of \( s \) for \( G \) and \( G \) generates \( t \), then \( G \) generates \( s \).

Example

I will **easily** ace this **really** exam

✓ I will **easily** ace this exam

✓ I will ace this **really** exam

* I will ace this exam
Theorem (Optionality Closure)

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Example

- I will easily ace this really exam
- I will ace this really exam
- I will easily ace this exam
- I will ace this exam
We abstract away from technical details of the grammar.

**Major Requirement**

Implementation of adjuncts and conjuncts must capture their optionality $\Rightarrow$ abstract notion of ojuncts

Grammars with ojuncts show special inference patterns:

- $\downarrow$ grammaticality is downward entailing with respect to $<_G$,
- $\uparrow$ ungrammaticality is upward entailing with respect to $<_G$. 
The AIC follows from **optionality closure and feature checking**.
Deriving the Adjunct Island Constraint

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

AIC Violation

1) Tree is an ojunct extension
The AIC follows from optionality closure and feature checking.

AIC Violation

1) Tree is an ojunct extension
2) Tree without ojunct violates feature calculus
Deriving the Adjunct Island Constraint

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

![Diagram](attachment:image.png)

**AIC Violation**

1) Tree is an ojunct extension
2) Tree without ojunct 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 ojunct extension
2) Tree without ojunct satisfies feature calculus
3) Grammaticality isn't upward entailing \( \Rightarrow \) nothing follows

which book \([-wh]\)

John

\(T'\)

\(T\)

\(CP\)

\(C'\)

did \([+wh]\)

\(TP\)

\(VP\)

\(PP\)

\(VP\)

\(VP\)

\(VP\)

\(VP\)

\(VP\)

\(PP\)

\(reading\)

\(e\)

\(sell\)

\(before\)
Why Parasitic Gaps are Different

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

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1) Tree is an ojunct extension
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Deriving the Coordinate Structure Constraint

**CSC Violation**

1) Ojunct extension of two trees
Deriving the Coordinate Structure Constraint

CSC Violation
1) Ojunct extension of two trees
2) Fine without second conjunct
Deriving the Coordinate Structure Constraint

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1) Ojunct extension of two trees
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Deriving the Coordinate Structure Constraint

CSC Violation
1) Ojunct extension of two trees
2) Fine without second conjunct
3) Nothing follows
4) Bad without first conjunct
CSC Violation

1) Ojunct extension of two trees
2) Fine without second conjunct
3) Nothing follows
4) Bad without first conjunct
5) Ungrammaticality is upward entailing
Why ATB Extraction is Different

CSC Exemption

1) Ojunct extension of two trees

The diagram illustrates a sentence structure with the following components:

- **CP**
- **C’**
- **&P**
- **did [+wh]**
- **TP**
- **Ed**
- **VP**
- **brew**
- **&’**
- **and**
- **TP**
- **Greg**
- **VP**
- **drink**

The phrase "which beer [-wh]" is also indicated.
Why ATB Extraction is Different

CSC Exemption
1) Ojunct extension of two trees
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Why ATB Extraction is Different

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Diagram:
- CP
- C’
- did [+wh]
- TP
- Greg
- VP
- drink
- which beer [-wh]
Why ATB Extraction is Different

CSC Exemption
1) Ojunct extension of two trees
2) Fine without second conjunct
3) Nothing follows
4) Fine without first conjunct
5) Nothing follows
Interim Summary

- Ojuncts are incompatible with instances of extraction that depend on the presence of the ojunct.
  - AIC violations
  - CSC violations

- All other kinds of extraction should be subject to cross-linguistic variation.
  - ATB (mover originates outside ojunct)
  - parasitic gaps (ojunct imposes constraints on tree, but not the other way round)
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Mathematical Fact
With feature-driven Move, all ojuncts are islands while still allowing for parasitic gaps and ATB extraction.

Empirical Assumptions
- Movement is always feature-driven.
- Adjuncts and coordinations are ojuncts.

Is this true?

The Issue
- Some phrases look like ojuncts yet are not islands.
- Two possible solutions
  - no movement/mandatory feature checking (stipulative)
  - optionality does not hold
The Account So Far

- **Mathematical Fact**
  With feature-driven Move, all ojuncts are islands while still allowing for parasitic gaps and ATB extraction.

- **Empirical Assumptions**
  - Movement is always feature-driven.
  - Adjuncts and coordinations are ojuncts.

Is this true?

**The Issue**

- Some phrases look like ojuncts yet are not islands.
- Two possible solutions
  - no movement/mandatory feature checking (stipulative)
  - optionality does not hold
In passives, \textit{by}-phrases are optional but do not block extraction. The same holds for instrumentals.

(11) \begin{enumerate}
\item a. Mary was assaulted \textit{(by John)} \textit{(with a hammer)}.
\item b. Which man was Mary assaulted \textit{by} \textit{t}?
\item c. What kind of weapon was Mary assaulted \textit{with} \textit{t}?
\end{enumerate}

However, these phrases are \textit{semantic arguments of the verb}. 
Truswell Sentences

Truswell adjuncts also allow for extraction. (Truswell 2007)

(12) Which car did John drive Mary crazy trying to fix \( t \)?

**Truswell’s Generalization**

Adjunct denotes an event \( e' \) that is related via \( R \) to the event \( e \) of the matrix clause

\[ \Rightarrow \text{ does not have standard (Neo-Davidsonian) denotation} \]

\[ \Rightarrow \text{ adjunct behaves more like a semantic argument} \]
Coordination without Parallelism

Extraction from a conjunct is fine if the coordination has serial or subordinate semantics.

(Culicover and Jackendoff 1997; Kehler 2002)

(13)  a. How many beers can you drink \( t \) and still stay sober?
    b. This is the guy that you sleep with \( t \) and end up with an STD.

Once again one cannot use the standard semantics for adjuncts/conjuncts.
more fine-grained classification than just argument vs adjunct
(cf. Dowty 2003; Needham and Toivonen 2011)

<table>
<thead>
<tr>
<th>syn-adjunct</th>
<th>sem-argument</th>
<th>sem-adjunct</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td>arguments</td>
<td>case-marked adjuncts(?)</td>
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whatever mechanism gives rise to the optionality of ojuncts also limits their semantic denotation

non-adjunct semantics implies usage of a different mechanism that does not give rise to optionality
The Big Picture

- **more fine-grained classification** than just argument vs adjunct
  (cf. Dowty 2003; Needham and Toivonen 2011)

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- whatever mechanism gives rise to the optionality of ojuncts also limits their semantic denotation
- non-adjunct semantics implies usage of a different mechanism that does not give rise to optionality
In **Neo-Davidsonian semantics**, adjunction to $\mathbf{XP}$ yields the conjunction of $[\mathbf{XP}]$ with a monadic predicate over an event.

(14)  

a. John runs.  
\[ \text{Ag}(\text{John}, e) \land \text{run}(e) \] 

b. John runs quickly.  
\[ \text{Ag}(\text{John}, e) \land \text{run}(e) \land \text{quickly}(e) \]

---

**Algebraic Observation**

- If phrases denote sets of events, adjuncts are intersective:  
  \[ \text{[run quickly]} = \text{[run]} \cap \text{[quickly]} \]

- Arguments are not:  
  \[ \text{[John runs]} = \text{[Ag(John)]} \cap \text{[runs]} \neq \text{[John]} \cap \text{[runs]} \]
In Neo-Davidsonian semantics, adjunction to $XP$ yields the conjunction of $[XP]$ with a monadic predicate over an event.

(14) a. John runs.
    $AG(John, e) \land run(e)$

b. John runs quickly.
    $AG(John, e) \land run(e) \land quickly(e)$

**Algebraic Observation**

- If phrases denote sets of events, adjuncts are intersective:
  $[\text{run quickly}] = [\text{run}] \cap [\text{quickly}]$

- Arguments are not:
  $[\text{John runs}] = [AG(John)] \cap [\text{runs}] \neq [\text{John}] \cap [\text{runs}]$
Let $\mathbb{E}$ be the set of all events, and $2^{\mathbb{E}}$ its powerset.

We can order the elements of $2^{\mathbb{E}}$ by the subset relation $\subseteq$.

This yields a Boolean lattice $\mathcal{E} := \langle 2^{\mathbb{E}}, \subseteq \rangle$, where

- the meet operation $\wedge$ is intersection, and
- the join operation $\vee$ is union.

Let $f$ be a semantic interpretation function that maps every phrase/word to an element of $\mathcal{E}$.

Semantically, adjunction of $A$ to $XP$ amounts to taking the meet $f(A) \wedge f(XP)$. 
Example Lattice for Adjunct Semantics

Example

Suppose:

- $f(\text{run}) = \{1, 2, 3\}$
- $f(\text{quickly}) = \{2, 3\}$
- $f(\text{John}) = \{1, 2\}$
- $f(\text{Ag}(\text{John})) = \{1\}$

Then:

- $f(\text{run quickly}) = f(\text{run}) \land f(\text{quickly}) = \{2, 3\} = \left[ \text{run quickly} \right]$  
- $f(\text{John runs}) = f(\text{John}) \land f(\text{runs}) = \{1, 2\} \neq \{1\} = \left[ \text{John runs} \right]$
Extension to Coordination

- Coordination is analyzed via **mereological sums**:

  \[ [\text{John and Mary}] = [\text{John}] \oplus [\text{Mary}] = \text{John} \oplus \text{Mary} \]

- If we take the set of individuals and all possible mereological sums thereof, we once again get a Boolean lattice.

- Semantically, coordination corresponds to meet in this lattice.
Example Lattice for Coordination Semantics

Example
\[ f(\text{John and Mary}) = f(\text{John}) \land f(\text{Mary}) = J \oplus M = [\text{John and Mary}] \]
Adjunction and coordination have similar semantics: meet over a specific lattice.

**Key idea for syntax**
- Merger of an adjunct equals meet over a syntactic lattice.
- Merger of an argument does not.

**Ojuncts** are introduced by an operation that corresponds to meet in the syntactic and semantic lattices.

If the syntax or semantics is more complicated than meet, then we are not dealing with an ojunct.
**Definition (Good Continuation)**

Tree $s$ is a good continuation of tree $t$ iff adding $s$ above $t$ yields a well-formed tree.

**Simplified Example**

- **Tree $s$**:
  - $S$
    - $DP$
      - $John$
    - $VP$
      - $quickly$
    - $VP$
      - $runs$

- **Good continuations of [VP runs]**:
  - $S$
    - $DP$
      - $John$
    - $VP$
      - $quickly$
    - $sqrt$

- **Tree $t$**:
  - $S$
    - $DP$
      - $John$
    - $VP$
      - $quickly$
    - $sqrt$

Good Continuations

Definition (Good Continuation)

Tree $s$ is a good continuation of tree $t$ iff adding $s$ above $t$ yields a well-formed tree.

Simplified Example

Tree: $S$

- $[DP \rightarrow John$ $VP \rightarrow VP \text{ quickly}]$
- $[VP \rightarrow VP \text{ runs}]$

Good continuations of $[VP \text{ runs}]$:

- $S$
  - $[DP \rightarrow John$ $VP \rightarrow \square \text{ quickly}]$
  - $[DP \rightarrow \square \text{ quickly}]$
  - $[DP \rightarrow John]$

Diagram: 

- $S$ leads to $DP$, $VP$, and $\square$.
Arguments, Adjuncts, and Continuations

- **Observation 1: Identifying trees with their continuations**
  Every tree can be associated with its set of good continuations. We also call this its continuation set.

- **Observation 2: Argument Merge is non-intersective**
  If tree $t$ is merged with argument $r$, they have disjoint continuation sets.
  - The good continuations of $t$ must include an argument like $r$.
  - The good continuations of $r$ cannot include an argument like $r$.

- **Observation 3: Adjunction is intersective**
  If tree $t$ can have an adjunct $a$, they have overlapping continuation sets.
  - The set of good continuations for $a$ includes trees without $a$.
  - By optionality, the set of good continuations for $t$ does, too.

In fact, the continuation set of the tree $t'$ that results from adjunction of $a$ to $t$ is exactly the intersection of their continuation sets.
Continuation Lattice

- Let $\mathcal{C}$ be the set of all continuations, and $2^E$ its powerset.
- We can order the elements of $2^E$ by the subset relation $\subseteq$.
- This yields the Boolean lattice $\mathcal{C} := \langle 2^E, \subseteq \rangle$, which has exactly the same properties as the event lattice and the mereology lattice.
- Let $f$ be a function that maps every phrase/word to an element of $\mathcal{C}$.
- Adjunction of $A$ to $XP$, yielding $t$, must obey the property that $f(t) = f(A) \land f(XP)$. 
Conclusion

- **Why do we see (strong) island effects?**
  Because islandhood is a necessary consequence of optionality given standard feature checking requirements.

- **Why are there exceptions?**
  Because some adjuncts/conjuncts have complex semantics that requires a more powerful operation
  \( \Rightarrow \) does not capture optimality

**Remaining Problems**

- adjunct/conjunct semantics can be more complicated
  (causation, tense, distributivity)

- cross-linguistic variation
  (e.g. extraction from relative clauses in Scandinavian)

- Why do resumptive pronouns repair island violations?
Conclusion

- **Why do we see (strong) island effects?**
  Because islandhood is a necessary consequence of optionality given standard feature checking requirements.

- **Why are there exceptions?**
  Because some adjuncts/conjuncts have complex semantics that requires a more powerful operation
  \( \Rightarrow \) does not capture optimality

**Remaining Problems**

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Why Islands May Move

Displacement of an ojunct possible via base merger

Tree:

```
CP
   / \
how C
   /   
  did TP
     /   
    John VP
       /   
      e    VP
         /   
        escape
```

Base Merge Exemption

1) Tree is an ojunct extension

Displacement of an ojunct possible via base merger
Why Islands May Move

Displacement of an ojunct possible via base merger

Base Merge Exemption

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

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Why Islands May Move

Displacement of an ojunct possible via base merger

Base Merge Exemption
1) Tree is an ojunct extension
2) Tree without ojunct satisfies feature calculus
3) Grammaticality isn’t upward entailing \( \Rightarrow \) nothing follows
Base Merger Extraction from Ojuncts is Still Impossible

AIC Violation

1) Tree is an ojunct extension

- CP
  - DP
    - which book
  - C'
    - did
  - TP
    - John
    - T'
      - T
        - VP
          - VP
            - fall asleep
          - PP
            - before
        - VP
          - reading
Base Merger Extraction from Ojuncts is Still Impossible

AIC Violation
1) Tree is an ojunct extension
2) Tree without ojunct has no valid “origin” e

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  DP
    which book
  C’
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    T’
      T
      VP
      fall asleep
Base Merger Extraction from Ojuncts is Still Impossible

AIC Violation
1) Tree is an ojunct extension
2) Tree without ojunct has no valid “origin” e
3) Ungrammaticality is upward entailing
Conjuncts and Agreement

At a surface-level, conjuncts matter for $\phi$-agreement and semantic number requirements.

(15) Ed *(and Greg) are brewing beer.
(16) Ed *(and Greg) met.

Possible Answer

- Optionality must hold with respect to morphological dependencies, not specific feature values.
- Semantic requirements are ignored.
Binding and NPIs in Coordinations

(17) a. ? Every woman and no man has ever had a period.  
b. * Every woman has ever had a period.  

(18) * (Jón og) afar sínir voru Jón and grandpas POSS-REFL.NOM.PL were glaðir.  
happy.NOM.PL  
‘(Jón and) his grandpas were happy.’  

Worrying, but all cases of extraction are deviant for independent reasons. Optionality is not the issue:  

(19) a. * Which actress has (every TMZ reporter and) no fanboy of t ever talked to?  
b. * Which field did the dean introduce every professor (of t) and no student of t to any senators?
Consequences

Optionality must be computed over abstract structures that allow us to ignore

- concrete $\phi$-feature instantiations,
- some semantic requirements
  - size of set denoted by DP,
  - NPI-licensing,
  - binding requirements.

If one relegates these conditions to PF and LF, then optionality — over syntactic trees with Agree dependencies — should apply to these cases.
Remaining Challenge 1: Cross-linguistic variation

- The class of ojuncts should be relatively stable across languages.
- But there is cross-linguistic variation, e.g. extractability from relative clauses in Scandinavian (Erteschik-Shir 1973).

A (Stipulative) Solution

Extraction from ojuncts is possible if the feature at the target site need not be checked. Languages could differ as to which features must always be checked.
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Remaining Challenge 2: Resumptive Pronouns

No island violations with resumptive pronoun instead of trace (e.g. Lebanese Arabic)

(20) ha-l-muttahame tfeeżaʔ to lamma/laʔ anno this-the-suspect.SGxFEM surprised.2 when/because ŋrəfto ʔanno hiyye nhabasit. know.2 that she imprisoned.3SGxFEM

‘This suspect, you were surprised when/because you knew that she was imprisoned.’ Aoun et al. (2001:575)

follows if binding rather than movement is involved

Problems

- Antecedent and adjunct must both be dropped
  ⇒ discontinuous ojuncts?
- Why only licit with overt pronouns?
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