Chapter 14, sections 14.1-14.4

Long Distance Dependencies

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Overview

- Some examples of the phenomenon
- What is new and different about it
- Brief sketch of the TG approach
- How we handle non-subject gaps
- Friday: Subject gaps and constraints on LDDs
- Monday: guest lecture, demo of a HPSG-based NLP system

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Examples

- *wh*-questions:

  What did you find?

  Tell me who you talked to

- relative clauses:

  the item that I found

  the guy who(m) I talked to

- topicalization:

  The manual, I can't find

  Chris, you should talk to.

- *easy*-adjectives:

  My house is easy to find.

  Pat is hard to talk to.

Topicalization example

"Me, you bring an empty food dish; *him*, you bring a leash."

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What these have in common

- There is a ‘gap’: nothing following *find* and *to*, even though both normally require objects.
- Something that fills the role of the element missing from the gap occurs at the beginning of the clause.
- We use topicalization and *easy*-adjectives to illustrate:

The manual, I can’t find _____

Chris is easy to talk to _____

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Gaps and their fillers can be far apart:

<u>The solution to this problem</u>, Pat said that someone claimed you thought I would never find____.

<u>Chris</u> is easy to consider it impossible for anyone but a genius to try to talk to_____.

☞ That's why we call them "long distance dependencies"

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Fillers often have syntactic properties associated with their gaps

Him, I haven't met___.
**He, I haven't met___.*

The scissors, Pat told us ____ were missing.
**The scissors, Pat told us ____ was missing.*

On Pat, you can rely___.
**To Pat, you can rely___.*

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LDDs in TG

- These were long thought to constitute the strongest evidence for transformations.
- They were handled in TG by moving the filler from the gap position.
- Case, agreement, preposition selection could apply before movement.

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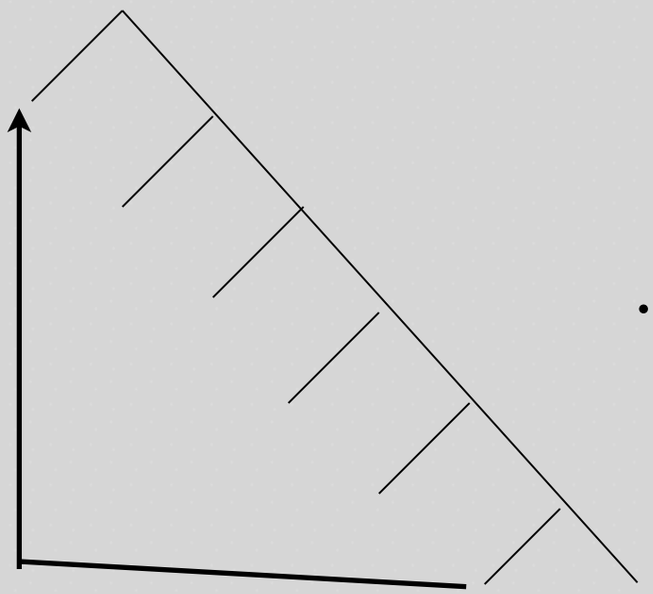
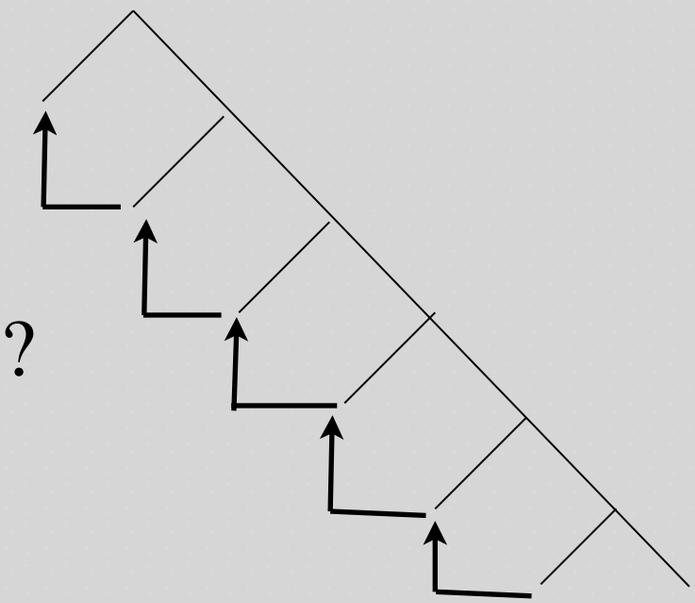
An old debate about LDDs in TG

- Does long-distance movement take place in one fell swoop .....



...or in lots of little steps?



Swooping

Looping

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Looping is now generally accepted in TG

- Various languages show morphological marking on the verbs or complementizers of clauses between the filler and the gap.
- Psycholinguistic evidence indicates increased processing load in the region between filler and gap.
- This opens the door to non-transformational analyses, in which the filler-gap dependency is mediated by local information passing.

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Very Rough Sketch of Our Approach

- A feature GAP records information about a missing constituent.
- The GAP value is passed up the tree by a new principle.
- A new grammar rule expands S as a filler, followed by another S whose GAP value matches the filler.
- Some complications involved in getting the details right…

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The Feature GAP

- Like valence features and ARG-ST, GAP's value is a list of feature structures (often empty).
- Subject gaps are introduced by a lexical rule we'll talk about next time.
- Non-subject gaps are introduced by revising the Argument Realization Principle.

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The Revised ARP

$$word\text{:}\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SPR} & \boxed{A} \\ \text{COMPS} & \boxed{B} \ominus \boxed{C} \end{bmatrix} \\ \text{GAP} & \boxed{C} \end{bmatrix} \\ \text{ARG-ST} & \boxed{A} \oplus \boxed{B} \end{bmatrix}$$

- $\ominus$ is a kind of list subtraction, but:
  - it's not always defined, and
  - when defined, it's not always unique
- The ARP now says the non-SPR arguments are distributed between COMPS and GAP.

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A Word with a Non-Empty GAP Value

$$\left\langle \text{hand}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \boxed{1}\ \rangle \\ \text{COMPS} & \langle\ \boxed{3}\text{PP[to]}\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \boxed{2}\text{NP[acc]}\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \overset{\boxed{1}\text{NP}}{\begin{bmatrix} \text{CASE} & \text{nom} \\ \text{AGR} & \textit{non-3sing} \end{bmatrix}}\ ,\ \boxed{2}\ ,\ \boxed{3} \right\rangle \end{bmatrix} \right\rangle$$

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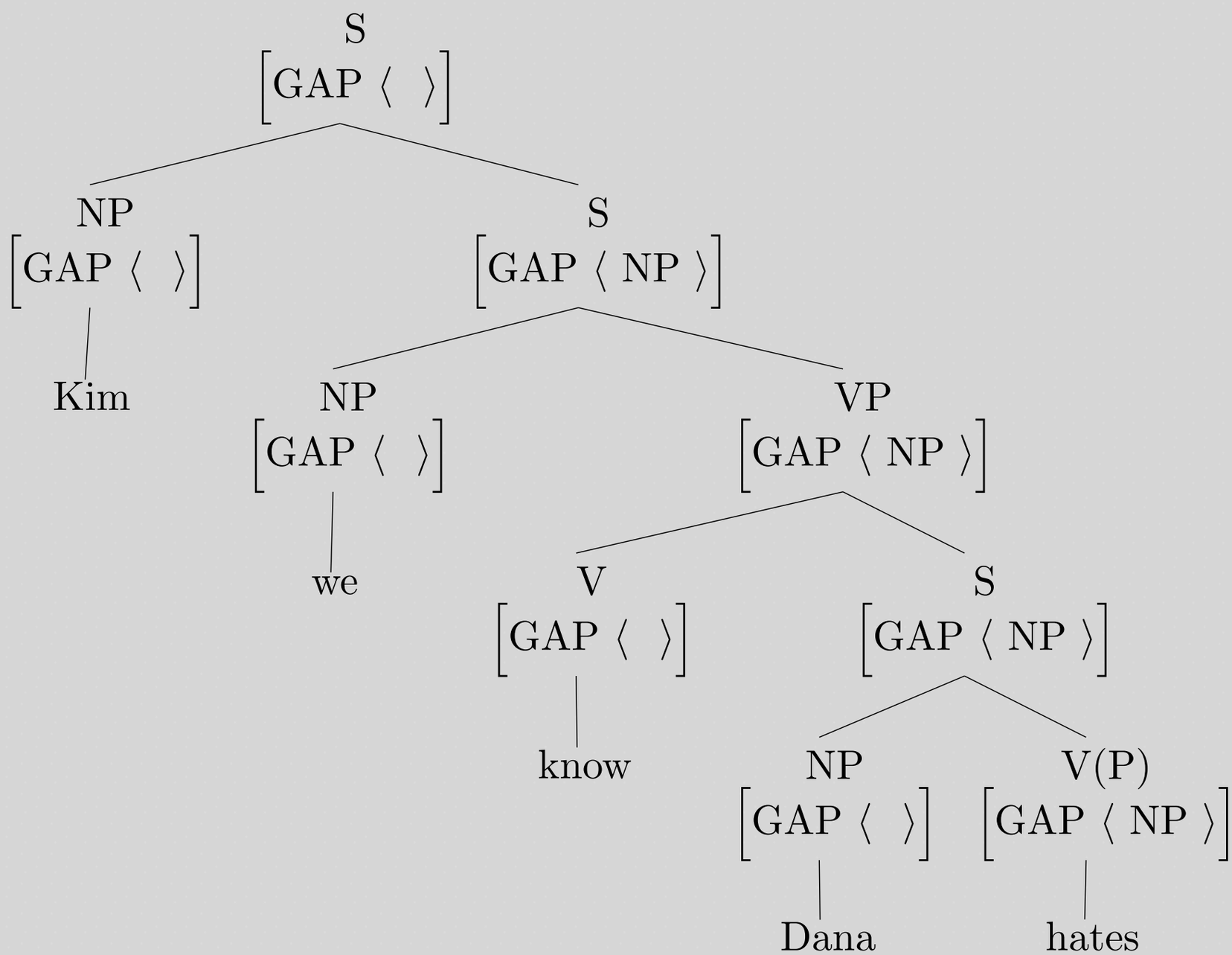
How We Want GAP to Propagate



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What the GAP Propagation Mechanism Must Do

- Pass any GAP values from daughters up to their mothers,
  - **except** when the filler is found.
- For topicalization, we can write the exception into the grammar rule, but
- For *easy*-adjectives, the NP that corresponds to the gap is the subject, which is introduced by the Head-Specifier Rule.
- Since specifiers are not generally gap fillers, we can't write the gap-filling into the HSR.

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Our Solution to this Problem

- For *easy*-adjectives, we treat the adjective formally as the filler, marking its SPR value as coindexed with its GAP value.
- We use a feature STOP-GAP to trigger the emptying of the GAP list.
  - STOP-GAP stops gap propagation
  - *easy*-adjectives mark STOP-GAP lexically
  - a new grammar rule, the Head-Filler Rule mentions STOP-GAP

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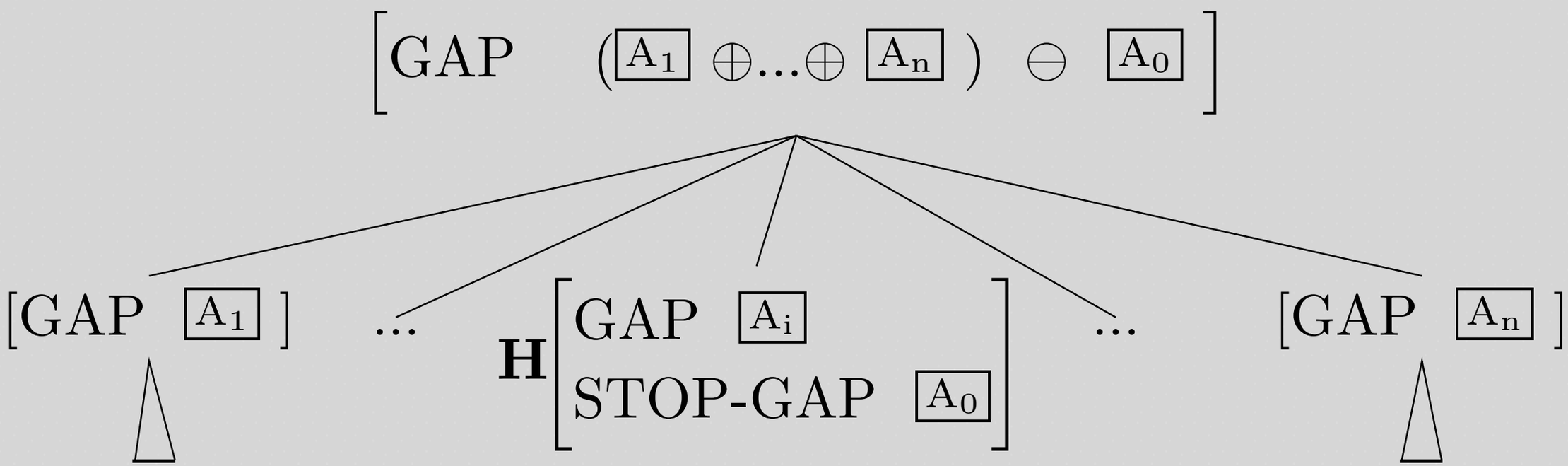
The GAP Principle

A local subtree Φ satisfies the GAP Principle with respect to a headed rule ρ if and only if Φ satisfies:



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How does STOP-GAP work?

- STOP-GAP is empty almost everywhere
- When a gap is filled, STOP-GAP is nonempty, and its value is the same as the gap being filled.
- This blocks propagation of that GAP value, so gaps are only filled once.
- The nonempty STOP-GAP values come from two sources:
  - a stipulation in the Head-Filler Rule
  - lexical entries for *easy*-adjectives
- No principle propagates STOP-GAP

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The Head-Filler Rule

$$[phrase] \rightarrow \boxed{1}\begin{bmatrix}\text{GAP} & \langle\ \rangle\end{bmatrix} \quad \mathbf{H}\begin{bmatrix}\text{HEAD} & \begin{bmatrix} verb & \\ \text{FORM} & \text{fin}\end{bmatrix} \\ \text{VAL} & \begin{bmatrix}\text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle\end{bmatrix} \\ \text{STOP-GAP} & \langle\ \boxed{1}\ \rangle \\ \text{GAP} & \langle\ \boxed{1}\ \rangle\end{bmatrix}$$

- This only covers gap filling in finite Ss
- The filler has to be identical to the GAP value
- The STOP-GAP value is also identical
- The GAP Principle ensures that the mother's GAP value is the empty list

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Gap Filling with *easy*-Adjectives

$$\left\langle \text{easy} \;,\; \begin{bmatrix} \textit{adj-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{STOP-GAP} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_i \;,\; \begin{bmatrix} \text{INF} & + \\ \text{GAP} & \langle \boxed{1}\text{NP}_i \;,\; \ldots \rangle \end{bmatrix}^{\text{VP}} \right\rangle \end{bmatrix} \right\rangle$$

- Because STOP-GAP and GAP have the same value, that value will be subtracted from the mother's GAP value.
- The first argument is coindexed with the GAP value, accounting for the interpretation of the subject as the filler.

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A Tree for *easy to talk to*___

$$\begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \boxed{2}\text{NP}_i\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \rangle \end{bmatrix}$$

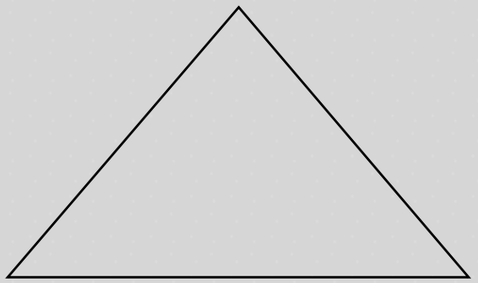
A

$$\begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \boxed{2}\ \rangle \\ \text{COMPS} & \langle\ \boxed{3}\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \rangle \\ \text{STOP-GAP} & \langle\ \boxed{1}\ \rangle \end{bmatrix}$$

easy

$\boxed{3}$VP

$$\begin{bmatrix} \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \text{NP}\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \boxed{1}\text{NP}_i\ \rangle \end{bmatrix}$$



to talk to __

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STOP-GAP Housekeeping

- Lexical entries with nonempty STOP-GAP values (like *easy*) are rare, so STOP-GAP is default empty in the lexicon.
- The head daughters in the Head-Specifier and Head-Modifier rules need to say [STOP-GAP < >]
- Lexical rules preserve STOP-GAP values.

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GAP Housekeeping

- The initial symbol must say [GAP < >]. Why?
  - To block **Pat found* and **Chris talked to* as stand-alone sentences.
- The Imperative Rule must propagate GAP values. Why?
  - It's not a headed rule, so the effect of the GAP Principle must be replicated
  - Imperatives can have gaps:
    This book, put on the top shelf!

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Sentences with Multiple Gaps

- Famous examples:

  This violin, sonatas are easy to play___ on___.

  **Sonatas, this violin is easy to play___ on___.*

- Our analysis gets this:
  - The subject of *easy* is coindexed with the **first** element of the GAP list.
  - The Head-Filler rule only allows one GAP remaining.
- There are languages that allow multiple gaps more generally.

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